Exhibit 28

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Counsel for Movant Anthony Hernandez Valadez

IN THE UNITED STATES BANKRUPTCY COURT
FOR THE DISTRICT OF NEW JERSEY

In re:	:	Chapter 11
	:	
LTL MANAGEMENT LLC,	:	Case No. 21-30589
	:	
Debtor.	:	
	:	

DECLARATION OF DEAN W. FELSHER, M.D., PH.D.

EXHIBIT 28

Pursuant to 28 U.S.C. § 1746, I, Dean W. Felsher, M.D., Ph.D., declare under penalty of perjury as follows:

1. I am an adult over the age of 18 years and not a party in this case. I have personal knowledge of the facts set forth in this declaration, except for such facts that have been made known to me in forming an opinion, in which case each such fact is of a type on which professionals in my field reasonably rely in forming such opinions. The facts stated in this declaration that are within my personal knowledge are true. If asked, I could and would testify competently to the truth of and foundation for each fact and opinion asserted within this declaration

2. Attached hereto as **Exhibit A** is a true and correct copy of my current curriculum vitae, which truthfully states my qualifications to provide expert testimony in this action

3. I hold a bachelor's degree from the University of Chicago in Chemistry. I also hold both an M. D. and a Ph.D. from the University of California Los Angeles. I did my residency in internal medicine at the Hospital of the University of Pennsylvania. I also performed my medical oncology fellowship training in hematology-oncology and post-doctoral research training under J. Michael Bishop, Nobel Laureate for discovery of oncogenes, at the University of California, San Francisco. I am board certified in internal medicine and medical oncology. After nearly 20 years of holding those certifications, I permitted them to lapse because I no longer maintain a continuity clinic. Instead, I now supervise doctors, medical students, fellows, and other clinical faculty and professors who treat hundreds of patients.

4. From December 1997 to September 1999, I served as a clinical instructor, an Assistant Adjunct Professor, and Assistant Professor at the University of California, San Francisco. In September 1999, I became an Assistant Professor of Medicine, Pathology, and

Oncology, and later promoted to Associate Professor with Tenure at Stanford University. In 2012, I became a full Professor of the Division of Oncology in the Departments of Medicine and Pathology at Stanford University. In 2020, I became the Associate Chief in the Division of Oncology. I am currently employed in that role. I teach, or have taught, clinics in medical oncology, oncogenes, cancer education, and translational medicine, and seminars in oncology, cancer pharmacology, cancer biology, immunology, pathology, carcinogenesis, and translational medicine. I currently direct many of these courses. I am also the founding Director of Stanford's Translational Research and Applied Medicine Center, Director of the Cancer Translational Nanotechnology Training Program, Director of Admissions for the Medical Scientists Training Program, Director of the Advanced Residency Training, and Director of the KL2 Faculty Mentorship. I have lectured on the causes of cancer in many courses at Stanford University.

5. I have over 30 years of experience in medical and oncology research, as well as over 20 years of clinical experience in oncology. Since 2001, I have served on over 20 Stanford University committees related to practice, selection, and training in the fields of medicine and oncology. I have trained over 75 college, medical, and post-doctoral fellow students, served on the editorial board of 13 cancer-related journals, and review for about 39 medical journals. I am presently a Senior Editor that works collaboratively as part of a team of senior editors at both the journals Cancer Research and Oncogene, which are two of the premiere international journals of cancer research in the world. In that role, I am responsible for deciding on the suitability for publication of hundreds of cancer studies each year regarding cancer biology and treatment. I also serve as a scientific reviewer for hundreds of manuscripts in over 20 of the top scientific journals in the world including Nature, Science, Cell, and Nature Medicine. I have served as a member of a team of experts to review the National Institute of Health research program in

Pathology research. I have received 40 honors and/or awards for my oncology work, including the National Institute of Health, Outstanding Investigator Award. I have been invited to speak at numerous international cancer-related conferences, given over 240 presentations on cancer-related topics, authored over 100 peer-reviewed cancer-related articles, and performed numerous other medical research-related work.

6. I spoke to Mr. Anthony Hernandez Valadez and his mother Ms. Anna Camacho on or around April 25, 2022. I understand that he is 23 years old and had daily exposures to Johnson's Baby Powder talc throughout his life. His mother used a large amount of Johnson's Baby Powder talc on Mr. Valadez from birth on September 23, 1998 and throughout his childhood. When Mr. Valadez was a baby, his mother regularly used a large amount of Johnson's Baby Powder talc on him every day, multiple times each day, including during diaper changes, after baths, to treat or prevent diaper rash, and whenever it was needed. His mother packed the baby powder throughout his body, including on his private areas, arms, neck, forehead, armpits, and chest. She applied the powder either directly from the bottle or with her hands. Mr. Valadez's mother also saw other family members apply Johnson's Baby Powder on him while he was a baby. Even after Mr. Valadez was no longer wearing diapers, his mother continued using Johnson's Baby Powder talc on him throughout his childhood. She applied that product in the same way and in the same areas as described above. In addition, his mother applied Johnson's Baby Powder on Mr. Valadez's feet and in between his toes, as well as inside his shoes. Mr. Valadez began using Johnson's Baby Powder talc on himself when he was around 13 years old and continued using it for several years thereafter. He used a lot of Johnson's Baby Powder talc throughout his body, including on his chest, armpits, private areas, back, and neck. His mother likewise knows that her son used Johnson's Baby Powder as a teenager because she

saw baby powder on his clothes and armpits. Mr. Valadez used Johnson's Baby Powder talc every day, multiple times each day, including after showers, before going out, or whenever he need to freshen up. He applied that product either directly from the bottle or with his hands. It took at least a couple of minutes for him to apply the powder. He used Johnson's Baby Powder talc in the manner described above always generating visible dust, that he actively breathed as a baby, child and adolescent.

7. I have reviewed Mr. Valadez's medical records and understand that his doctors diagnosed him with pericardial mesothelioma. On February 17, 2022, Mr. Valadez underwent invasive surgery, including a pericardiectomy and a resection of the mediastinal mass and thymectomy. Attached hereto as **Exhibit B** is a true and correct copy of the Operative Reports dated February 17, 2022. Mr. Valadez's treating surgeons found "[d]iffuse tumor involvement of the pericardium with areas of invasion into the myocardium." [Exh. B at 119, 121.] The clinical diagnosis included bilateral pleural effusions, pericardial constriction, and pericardial mesothelioma. [*Id*. at 118.]

8. Pericardial mesothelioma is a very rare cancer that affects the lining of the heart, known as the pericardium. The medical and scientific literature demonstrates that asbestos exposure in babies and children is a risk factor for mesothelioma and the relative risk for mesothelioma when exposed as such can be greater than when exposed as an adult and that asbestos exposure is a cause of malignant pericardial mesothelioma. Among others, the supporting publications include the following:

- Committee on Carcinogenicity of Chemicals in Food, Consumer Products and the Environment: A Statement on the Relative Vulnerability of Children to Asbestos Compared to Adults. UK Government (2013). [**Exhibit C** hereto.] The committee concluded that the lifetime risk of developing mesothelioma is predicted to be about 3.5 times greater for a child first exposed to asbestos at age 5 compared to an adult first

exposed at age 25 and about 5 times greater when compared to an adult first exposed at age 30.

- Dalsgaard, et al., Cancer Incidence and Risk of Multiple Cancers after Environmental Asbestos Exposure in Childhood—A Long-Term Register-Based Cohort Study, 19 Internat. J. Environ. Res. Public Health 268 (2022). [**Exhibit D** hereto.] The investigators found in a cohort of cohort of 12,111 children, that the incidence of malignant mesothelioma and the overall cancer incidence were significantly increased amongst those who attended school and lived near a large asbestos cement plant. The standardized incidence rates (SIRs) for asbestos-associated cancers, all cancers, and multiple cancers using rates for a gender and five-year frequency-matched reference cohort were measured. The overall incidence of cancer was modestly increased for the school cohort (SIR 1.07, 95% confidence interval (CI) 1.02–1.12) compared with the reference cohort. They found this excess was driven primarily by a significantly increased SIR for malignant mesothelioma (SIR 8.77, 95% CI 6.38–12.05). They concluded that their study confirms a strong association between environmental asbestos exposure and malignant mesothelioma and suggests that environmental asbestos exposure in childhood may increase the overall cancer risk later in life.

- Fazzo, et al., *Early mortality from malignant mesothelioma in Italy as a proxy of environmental exposure to asbestos in children*, 56 Ann. Ist. Super Sanità 478 (2020). [**Exhibit E** hereto.] The authors note that Malignant mesothelioma (MM) in ≤50 years old people, considering the long latency, is likely related to asbestos exposure in childhood. They measured MM (among ≤50 years (ys) old people in Italy, in 2003-2016. National and regional Standardized Rates (SRs) were computed by age-class. They found that the mortality from MM is a proxy of childhood environmental asbestos exposure.

- World Health Organization; *Tumours of the Lung, Pleura, Thymus and Heart* (2004) [**Exhibit F** hereto]: this publication explains that malignant pericardial mesothelioma, like the pleural type, is caused by asbestos (p. 286). By definition, the pericardial and pleural types are histopathologically and immunohistochemically similar. "Histopathology" refers to the microscopic examination of diseased cells and tissues removed from a patient's body and placed onto glass slides. "Immunohistochemistry" refers to the diagnosis of cancer cells through the use of stains that react to particular chemicals in a patient's tissue samples.

- Beck, et al.; *Malignant Pericardial Mesotheliomas and Asbestos Exposure: A Case Report* (1982) [**Exhibit G** hereto]: this report addressed cases of the disease among patients who had known prior asbestos exposures and sufficient latency periods (p. 158). It concluded, "pericardial mesotheliomas also strongly suggest some connection with exposure to asbestos" (p. 158).

- Butz, et al.; Primary malignant pericardial mesothelioma – a rare cause of pericardial effusion and consecutive constrictive pericarditis: a case report (2009) [**Exhibit H** hereto]: this report addressed a case of the disease in a patient who had a history of asbestos exposure as a schoolteacher (p. 3).

- Churg, et al.; *Malignant Mesothelioma Arising after Direct Application of Asbestos and Fiber Glass to the Pericardium* (1978) [**Exhibit I** hereto]: this report addressed a case of the disease in a patient who had surgically applied asbestos and glass fibers (p.419).

- Fujiwara, et al.; *An Autopsy Case of Primary Pericardial Mesothelioma in Arc Cutter Exposed to Asbestos through Talc Pencils* (2005) [**Exhibit J** hereto]: this report addressed a case of the disease in a patient who had a history of asbestos exposure at an ironworks facility (p. 346).

- Gemba, et al.; *National survey of malignant mesothelioma and asbestos exposure in Japan* (2012) [**Exhibit K** hereto]: this report addressed cases of the disease reported in Japan's Vital Statistics survey (p. 483). The study collected survey data and followed up with investigations of the patients' asbestos exposures. Of the seven patients, five had known asbestos exposures (pp. 484, 485).

- Kahn, et al.; *Primary Pericardial Mesothelioma following Exposure to Asbestos* (1980) [**Exhibit L** hereto]: this report addressed a case of the disease in a patient who had a history of asbestos exposure in shipyards (p. 270). It concluded, "this case provides strong evidence for an asbestos-induced mesothelioma arising in the pericardium" (p. 277). It suggested the fibers reached the pericardium by penetration from the pleura, or by flowing through the lymphatic system (p. 280).

- Kaul, et al.; *Primary malignant pericardial mesothelioma: A case report and review* (1994) [**Exhibit M** hereto]: this report addressed a case of the disease in a patient who had a history of asbestos exposure, although undescribed (pp. 261, 264).

- Llewellyn, et al.; *Pericardial constriction caused by primary mesothelioma* (1987) [**Exhibit N** hereto]: this report addressed a case of the disease in a patient who likely had a history of asbestos exposure as a seaman (p. 54).

- Marinaccio, et al.; *Incidence of extrapleural malignant mesothelioma and asbestos exposure, from the Italian national register* (2010) [**Exhibit O** hereto]: this report addressed cases of the disease reported in Italy's tumor registry (pp. 760, 761). The study collected registry data and followed up with investigations of the patients' asbestos exposures. Most of the patients had known asbestos exposures (p. 761). In concluded that one should exercise, "caution in discussing the role of etiological factors other than asbestos" (p. 764).

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- Mensi, et al.; *Pericardial mesothelioma and asbestos exposure* (2010) [**Exhibit P** hereto]: this report addressed cases of the disease reported in Italy's tumor registry, focusing on an industrialized region of the country (p. 1). The study collected registry data and followed up with investigations of the patients' asbestos exposures. Most of the patients had known asbestos exposures (p. 3). It concluded, "Our findings support the role of asbestos in the pathogenesis of PM" (p. 3).

- Nilsson, et al.; *Primary Pericardial Mesothelioma: Report of a Patient and Literature Review* (2009) **Exhibit Q** hereto]: this report addressed a case of the disease in a patient who likely had a history of asbestos exposure as a metal worker (p. 126).

- Papi, et al.; *Malignant Pericardial Mesothelioma: Report of Two Cases, Review of the Literature and Differential Diagnosis* (2005) [**Exhibit R** hereto]: this report addressed a case of the disease in a patient who likely had a history of asbestos exposure as a painter (p. 276).

- Rizzardi, et al.: *Primary Pericardial Mesothelioma in an Asbestos-exposed Patient with Previous Heart Surgery* (2010) [**Exhibit S** hereto]: this report addressed a case of the disease in a patient who had a history of asbestos exposure as a plumber (p. 1323).

- Sharma, et al.; *Primary Malignant Pericardial Mesothelioma Presenting as Effusive-Constrictive Pericarditis* (2011) [**Exhibit T** hereto]: this report addressed a case of the disease in a patient who had a "remote" history of asbestos exposure, although undescribed (p. 1).

- Thomason, et al.; *Primary Malignant Mesothelioma of the Pericardium:* Case Report and Literature Review (1994) [**Exhibit U** hereto]: this report addressed a case of the disease in a patient for whom asbestos-exposure information was not specified. It noted that other reported cases have included such information (p. 172).

- Vavalle, et al.; *Surprising finding of a primary pericardial mesothelioma* (2010) [**Exhibit V** hereto]: this report addressed a case of the disease in a patient who had a "remote" history of occupational asbestos exposure (p. 626).

- Emory, et al., *Malignant Mesothelioma Following Repeated Exposures to Cosmetic Talc: A Case Series of 75 Patients* Am. J. Ind. Med. 484 (2020) [**Exhibit W** hereto]: Cases of mesothelioma have been observed in persons who have used cosmetic talc powder. In Emory, et al., a patient whose only known exposure to asbestos was repeated use of cosmetic talc powder later developed pericardial mesothelioma. [*Id.* at 484-486.]

- Marinaccio, et al., *Association between asbestos exposure and pericardial and tunica vaginalis testis malignant mesothelioma: a case-control study and epidemiological remarks*, 46 Scand. J. Work Environ. Health 609 (2020) [**Exhibit X** hereto]. This case

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control study found that occupational exposure of asbestos was associated with pericardial and testis mesothelioma.

9. Based on the (i) factual assumption regarding the asbestos content of Johnson's Baby Powder, (ii) my education and experience, (iii) my review of the above-mentioned case-specific materials, including my interview with Mr. Valadez and his mother, and (iv) my review of the scientific literature identified above, it is my opinion, to a reasonable degree of medical and scientific certainty, that Mr. Valadez's exposure to asbestos through his inhalation of talc baby powder was a substantial factor increasing Mr. Valadez's risk of developing mesothelioma.

Pursuant to 28 U.S.C. § 1746, I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief. I executed this Declaration on May 23, 2022 at San Mateo, California.

By: ______________________________
DEAN W. FELSHER, M.D., Ph.D.

Exhibit A

Biographical and Bibliographic Information

Identifying Information:

Name:	Dean W. Felsher MD PhD
Citizenship:	United States of America

Academic History:

<u>Colleges and University</u>

9/81-7/85	University of Chicago, B.A.
7/85-7/92	University of California, Los Angeles, M.D., PhD.
7/92-6/94	Hospital of the University of Pennsylvania, Resident, Internal Medicine
7/94-6/99	University of California, San Francisco, Fellow, Hematology-Oncology

<u>Scholarships and Honors</u>

1985	Special Honors, Chemistry, University of Chicago
1992	Emil Bogen Research Award for Excellence in Science
1985-1992	Medical Scientist Training Program

<u>Residency and Post-Doctoral Training</u>

7/92-6/94	Resident, Hospital of the University of Pennsylvania, Internal Medicine
7/94-6/99	Fellow, University of California, San Francisco, Hematology-Oncology
7/95-6/99	Fellow, University of California, San Francisco, J. Michael Bishop's Laboratory

<u>Board Certification</u>

1996	Internal Medicine
1998	Medical Oncology

<u>Employment History:</u>

12/97-7/98	Clinical Instructor, Department of Medicine, UCSF
7/98-9/99	Assistant Adjunct Professor, Step I, Department of Medicine, UCSF
9/1/99-12/1/99	Acting Assistant Professor, Division of Oncology, Department of Medicine, Stanford University
12/1/99-	Assistant Professor, Division of Oncology, Department of Medicine, Stanford University
11/1/01-	Assistant Professor, Division of Oncology, Departments of Medicine and Pathology, Stanford University
2/1/07-	Associate Professor, Division of Oncology, Departments of Medicine and Pathology, Stanford University
8/01/12-	Professor, Division of Oncology, Departments of Medicine and Pathology, Stanford University.

EXHIBIT A

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Public and Professional Service:

Departmental Affiliations and Leadership
Associate Chief, Division of Oncology, Department of Medicine, Stanford University
Department of Pathology, Stanford University
Founding Director of Translational Research and Applied Medicine (TRAM)
Director of Oncology Research, Division of Oncology
Director of Admissions, Medical Scientist Training Program (MSTP)
Director of Advanced Residency Training Program (ARTS)
Director of Team Science, Department of Medicine
Co-Director Cancer Nanotechnology Training (C-TNT)
Co-Director KL2 Mentored Training Program
Member Stanford Comprehensive Cancer Institute
Member Molecular Imaging Program
Member Tumor Biology Training Program
Member Immunology Training Program
Member BioX Selection Committee
Member Canary Institute
Member ChEM-H

Graduate Programs

2000-	Cancer Biology, Stanford University
2001-	Immunology, Stanford University

Research and Professional Experience

7/85-7/92	Medical Scientist Training Program, UCLA
7/87-7/91	Graduate Student, MBI, UCLA, advisor: Dr. Jonathan Braun
7/92-6/94	Resident, Hospital of the University of Pennsylvania
7/94-6/97	Fellow, Division of Hematology-Oncology, UCSF
7/95-6/99	Fellow, Hooper Foundation, advisor: Dr. J. Michael Bishop
7/98-9/99	Assistant Adjunct Professor, Department of Medicine, UCSF
9/99-	Assistant Professor, Department of Medicine, Stanford University
11/01-	Assistant Professor, Departments of Medicine and Pathology, Stanford University
02/01/07-	Associate Professor, Division of Oncology, Departments of Medicine and Pathology, Molecular Imaging, Stanford University
09/01/12-	Professor, Division of Oncology, Departments of Medicine and Pathology, Molecular Imaging, Stanford Imaging
10/01/16-	Director of Research, Division of Oncology, Stanford University
07/02/18-	Director of Advanced Residency Training (ARTS)
07/01/20-	Co-Director, CTSA KL2 Mentored Training Program
07/01/20-	Associate Chief, Division of Oncology, Stanford University
07/01/20-	Director of Team Science, Department of Medicine

Clinical Experience

6/94-7/96	General Oncology, UCSF-Mt. Zion
8/96-1/98	AIDS Oncology, San Francisco General Hospital
2/99-6/15	General Oncology and Lymphoma, Stanford University

University Services

2001-2006	Internal Medicine Housestaff Selection Committee, Department of Medicine,
2001-	Center for Clinical Immunology, Steering Committee Member
2001-	Medical Scientist Training Program Admission Committee
2002-2005	Immunology Graduate Program Admission Committee
2002-	Organizer, Division of Oncology Annual Retreat
2002-	Member, Digestive Diseases Consortium, Stanford University
2002-2005	Cancer Biology Graduate Program, Executive Steering Committee
2005-	Tumor Biology Training Program, Executive Steering Committee
2005-2009	Dean's Committee on Animal Research
2005-	Member, Stanford Comprehensive Cancer Center
2005-	Faculty Co-Leader, Stanford Comprehensive Cancer Center Transgenic Core Facility
2006-	Review Panel Bio-X Interdisciplinary Research Initiative
2006-2010	Chair, Grants Committee, Stanford's Center for Children's Brain Tumors
2007-	Member, Advanced Residency Training at Stanford Program
2007-2011	Leader, Molecular Therapeutics Program, Stanford Cancer Center The development of a new program including programmatic development, an annual symposium, 3 invited speakers per year and support for joint grant applications.
2008-	Faculty Member, Molecular Imaging Program
2011-	Founding Director, Translational and Applied Medicine Program (TRAM), Department of Medicine: An integrated translational research program that I am the founding Director includes: pilot grants (15-20 funded projects per year), MED121/221 year-long training course, an TRAM Annual Symposia, 18 invited speaker , 3 educational talks, 3 workshops in bioinformatics, industry-academic interactions stem cell biology and infectious diseases, and a dedicated translational research core facility run by two senior scientists, 4 faculty advisory and 3 external advisors.
2014-	SPECTRUM Council of Mentors
2016	Co-Director and Co-PI Cancer Nanotechnology Training Program, Radiology: A mentored research training program funded by a NIH T32 to support integrated research in cancer and nanotechnology involving molecular imaging, diagnostics and therapeutics.
2017-2020	Director of Oncology Research, Division of Oncology: I coordinate funding, semi-annual research retreats, annual Oncology division retreat, pilot funding and NIH T32 Oncology training grant.
2017-	Associate Director and Director of Admissions Medical Scientist Training Program: I am responsible for review of all applications and selecting interview candidates and admission committee for the Stanford MSTP program.
2018-	Director of Advanced Residency Training (ARTS) Program, a PhD granting program for medical doctors during their clinical training that supports up to 10 candidates.
2019-	Co-Director of KL2 Program: I am responsible for providing training, and mentorship for junior medical faculty in the School of Medicine.
2020-	Associate Chief of Oncology: I am responsible for scientific affairs in the division including mentorship and support and training of junior research faculty and support for our medical oncology research programs.

<u>Clinical Teaching</u>
Medical Oncology Attending, Med X, Stanford Hospital
Med X Lecture Series: Oncogenes as Targets for Therapy of Human Neoplasia
Medical Oncology Journal Club
Cancer Education Seminar
Translational Medicine MED121/221
MSTP
ARTS Program
KL2 Mentored Training
Cancer Nanotechnology
ReCap

<u>Community Service</u>
Highlands Elementary School, Science Fair Judge, 2003
Highlands Elementary School, Science Fair Judge, 2004
Baywood Elementary School Science Fair Judge, 2007
American Cancer Society, Lecture, Spring 2004
NIH Step-up Program/UCSF High School Program, Lecture, 2004
Leukemia and Lymphoma Society MWOY Campaign 2010
Medical School Outreach 2017-
SUMMA 2017-

<u>Teaching Activities /Courses</u>

Fall 2000	Discussion Leader, Cell Signaling and Cancer Mol Pharm 210/Cancer Bio 242
2001-2002	Discussion Leader, Cancer Biology Graduate Program Journal Club
Winter 2001	Faculty Speaker, Cancer Biology, 241
Winter 2002	Faculty Speaker, Cancer Biology 241, Study and Treatment of Cancer
Spring 2002	Faculty Speaker, Cancer Biology 243, Tumor Suppressor Genes
Spring 2002	Faculty Speaker, Advanced Immunology II
Spring 2003	Faculty Speaker, Pathology 243, Lecture: Carcinogenesis
Spring 2003	Faculty Speaker, Biology 205, DNA Repair
Fall 2004	Faculty Speaker, Cancer Biology
Spring 2004	Faculty Speaker, Advanced Immunology II
Fall 2004	Faculty Speaker, Pathology 243, Lecture: Carcinogenesis
Winter 2004	Faculty Speaker, Pathology 243, Lecture: Carcinogenesis
Fall 2005	Faculty Speaker, Pathology, 243, Lecture: Carcinogenesis
Winter 2005	Faculty Speaker, Pathology, 243, Lecture: Carcinogenesis
Winter 2006	Faculty Speaker, Health and Human Disease, Lecture: Carcinogenesis
Winter 2007	Faculty Speaker, Health and Human Disease, Lecture: Carcinogenesis/Immunity
Spring 2008	Faculty Speaker, Health and Human Disease, Lecture: Carcinogenesis
Winter 2008	Faculty Speaker, BIOE22B
Spring 2008	Faculty Speaker, CCRTP Course
Spring 2009	Faculty Speaker, Neoplasia, Carcinogenesis and Immune Surveillance
Spring 2009	Faculty Speaker, CCRTP Course
Spring 2010	Faculty Speaker, Advanced Immunology II
Spring 2010	Faculty Speaker, Cancer Biology, 222C
Spring 2010	Faculty Speaker, CCRTP Course
Spring 2011	Faculty Speaker, Health and Human Disease, Lecture: Cancer Biology
Spring 2011	Faculty Speaker, Advanced Immunology II

Spring 2011	Faculty Speaker, CCRTP Course
Spring 2012	Faculty Speaker, Neoplasia, Carcinogenesis and Immune Surveillance
Winter 2013	Faculty Speaker, Cancer Biology 241, Tumor Immunology
Spring 2013	Faculty Speaker, Advanced Immunology
Spring 2013	Faculty Speaker, Lung Block, Human Health & Disease Course
Fall 2013	Faculty Speaker, CCRTP Course, Mouse Models
Winter 2014	Faculty Speaker, Cancer Biology 241
Winter 2015	Faculty Speaker, Pathology 290
S, W, F	Faculty Director and Speaker, MED121/221
S, W, F. 2016	Faculty Director and Speaker MED121/221
Spring 2016	Faculty Speaker, HHD 221 Lecture
Spring 2016	Faculty Speaker, Immunology 209, Immune Checkpoints
S, W, F 2017-2018	Faculty Director and Speaker MED121/221
Spring 2017	Faculty Speaker, HHD Human Cancer Biology Lecture
Spring 2017	Faculty Speaker, Oncology Lecture, Grantsmanship and Funding
Spring 2017	Faculty Speaker, MSTP Lecture, Oncogene Addiction
S, W, F 2018-2019	Faculty Director Speaker MED121/221
Spring 2019	Faculty Speaker, KL2
S, W, F. 2019-2020	Faculty Director and Speaker MED121/221
S, W, F 2020-2021	Faculty Director and Speaker MED121/221
S, W, F. 2021-2022	Faculty Director and Speaker MED121/221
Spring 2021	Faculty Speaker, Immunology 258, Ethics, Science, and Society
S, W, F 2021-2022	Faculty Speaker, ReCAP

Trainees

High School Students

2003	Michael Lin, UCLA MD, resident Stanford University
2004	Talia Lincoln, Medford College
2004-2005	Julian Burns, UCSD Medical Scholars Program
2006	Charles Liu, Harvard University
2010	Julia Arzeno, UCLA Medical School
2011	Nnola Amuzie, Stanford University

College Students

2000-2001	Shelly Beer, UCLA, Stanford PhD, Merck
2000-2001	Sui Sui Song, Cornell University, Stanford Medical Student
2000-2001	Sandy Jung, Stanford University, Resident Harbor-General UCLA
2001-	Charles Feng, Stanford University, Honors, UCLA Medical School
2002-2003	Jared Miller, Stanford University, Washington University, Med Student
2003-2007	Maria Chang, Stanford University, NIH Scholar Program
2004-2008	Michael Lin, Stanford University, UCLA Medical Student
2004-2006	Cynthia Zamora, Stanford University, UCSF Medical School
2004-2009	Kim Komatsubara, Stanford University, UCLA Medical School
2004-2006	Talia Lincoln, Medford College
2004-2006	Julian Burns, currently in the UCSD Medical Scholars Program
2005	Troy McEachron, Stanford University, NYU Graduate Program
2005-2006	Ogechi Amarachukwu Okolo, Stanford University
2006-2008	Ada Yee, Stanford University, Stanford PhD, currently Editor, Nature

2006-2008	Jessie Tao, Stanford University, Harvard Medical School, Johns Hopkins
2006-2008	Stephen Hinshaw, Stanford University, currently RA Harvard U.
2006-2008	Joy Chen, Stanford University, Case Western Med Student, Stanford Surgery
2007-2008	Peter James Bellisle, Stanford University
2007-2010	Ramya Parameswaran, Stanford University, MSTP U. Chicago
2008-2010	Evan Chen, Stanford University, currently Stanford Medical Student
2009	Michael Sanchez, Stanford University
2009-2011	Sashendra Ravinath Aponso, Stanford University, Duke Singapore Program
2008	Erin Young, Utah State University
2009-2012	Vanessa Chang, Stanford University, U. Penn MSTP
2011-2014	Christine Yost, Stanford University, Baylor Medical School
2012-2016	Rachel Do, Stanford University, Vanderbilt Medical School
2012-2013	Julia Arzeno, UCLA, currently UCLA Medical School
2012-2015	Alia Yaghi, Stanford University, U. Texas, San Antonio Medical School
2014-2016	Georgia Toal, Stanford University, currently Stanford University Medical School
2015-2018	Theodore Hu, Stanford University, currently Masters Program, Cambridge
2017-2020	Maya Krishnan, Stanford University, currently MSTP Student
2018-2020	Natalie Wu, UC Davis, currently medical student
2019-	Fidelia Alvina, U. Wisconsin Medical School,
2019-2021	Baokun Gu (Jack), Stanford University
2019-2020	Bryce Rossellini, Santa Clara University
2019-2020	Richard Barros, SFSU
2021-	Nikhiya Shamsher, Stanford University
2021-	Jessica Layne, Stanford University
2021-	Connor Gonzales, Stanford University

Graduate Students/Medical Students

2001-2003	Asa Karlsson, Division of Oncology, Stanford University and University of Goteberg
2001-2007	Constadina Arvanitis, Biological Sciences, Stanford University
2001-2007	Shelly Beer, Cancer Biology, Stanford University
2002-2004	Andrew Kopelman, Stanford School of Medicine, Stanford Med Scholar/HHMI
2004-2008	Pavan Bachireddy, Stanford School of Medicine, Stanford Med Scholar/HHMI
2004-2008	Pavan Bendapudi, Stanford School of Medicine, Stanford Med Scholar/HHMI
2005-2012	Peter Choi, Immunology Program, Stanford University
2005-2012	Alper Yetil, Biological Sciences Program, Stanford University
2006-2007	Melissa Horoschak, Stanford School of Medicine, Stanford Med Scholar
2006-2012	Kavya Rakhra, Immunology Program, Stanford University
2007-2009	Mathias Orbin, Medical Student, Munich, German
2014-2016	Rebecca Gao, Stanford Medical Student, Med Scholars
2016-2019	Nia Tope Adeniji, Stanford Medical Student, Med Scholars, UCSF Residency
2016-2017	Michael Richardson, Stanford Medical Student, Med Scholars
2017-2018	Line Heftdal, Aarhus University Medical Student, Danish Society
2021-	Josiah Yarbrough, Stanford University

Post-Doctoral Fellows

2000-2002	Flora Tang, MD, Current Position: PKPD Analyst, Genentech
2000-2001	Meenakshi Jain, MD Current Position: Staff Physician, Santa Clara Valley Medical Center

2001-2005 Debabrita Deb, PhD, Fellow of Tumor Biology Training Grant
Current Position: Leadership Team, Inscopix

2001-2005 Sylvie Giuriato, PhD, Fellow of Lymphoma Foundation
Current Position: Research Scientist, Tolouse, France

2001-2006 Catherine Shachaf, PhD, Fellow FAMRI award
Current Position: President, Stelo Technologies

2002-2005 Karen Rabin, MD, Fellow of the Berry Foundation
Current Position: Associate Professor, Pediatrics, Baylor University

2002-2005 Suma Ray, PhD, Fellow of Stanford Dean's Scholar Award
Current Position: Vice President, Intas Pharmaceuticals

2002-2007 Alice Fan, MD, Fellow of the Leukemia and Lymphoma Society
Current Position: Assistant Professor Division of Oncology, Stanford

2002-2007 Chi-hwa Wu, PhD, Fellow of Immunology Training Program
Current Position: Scientist, Complete Genomics

2003-2007 Asa Karlsson, PhD, Fellow of Cancer Biology Training Grant
Current Position: Scientist Karolinska

2005-2012 Jan van Riggelen, PhD, Fellow of the Lymphoma Research Foundation
Current Position: Assistant Professor, Georgia Institute of Technology

2006-2009 Phuoc Tran, MD PhD, Fellow in Radiation Oncology
Current Position: Associate Professor, Johns Hopkins University

2006-2007 Ling Liu, PhD, Post-Doctoral Fellow
Current Position: Fellow, Dr. Tom Rando, Stanford

2006-2008 George Horng, Stanford University, Fellow Pulmonary Program
Current Position: Pulmonologist Palo Alto Clinic

2007-2012 David Bellovin, PhD, Post-Doctoral Fellow, NIH NRSA Award
Current Position: Director, Zai Lab

2007-2012 Aleksey Yevtodiyenko, PhD, Post-Doctoral Fellow, Immunology Training Program
Current Position: Scientist, Life Sciences and Technology

2007-2012 Stacey Adam, PhD, Post-Doctoral Fellow, ACS Fellowship Award
Current Position: Director, Cancer in Research Partnerships Foundation

2007-2009 Zhongwei Cao, PhD, Post-Doctoral Fellow
Current Position: Assistant Professor, NYU

2007-2014 Yulin Li, PhD, Post-Doctoral Fellow, USC-NIH PSOC
Current Position: Assistant Professor, Methodist Hospital

2009-2015 Emelyn Shroff, PhD, Post-Doctoral Fellow, American Lung Fellowship
Current Position: Senior Research Officer, Public Health Ministry, Seychelles

2009-2013 Bikul Das, PhD, Post-Doctoral Fellow, Canadian Cancer Fellowship
Current Position: Assistant Professor, Forsythe Institute, Boston, MA

2010-2013 Tahera Zabuawala, PhD, Post-Doctoral Fellow
Current Position: Project Manager, Personalis

2011- Ling Tong, PhD, Fellow, BioX-Sanofi
Current Position: Instructor

2012-2018 Stephaney Casey, PhD, Post-Doctoral Fellow, NIH NRSA, CRI, K22
Current Position: Amgen Scientist

2012- Meital Gaby, PhD, Post-Doctoral Fellow, SIP Award
Current Position: Google X

2013-2018 Dan Koch (now Liefwalker), PhD, Fellow, Burroughs Wellcome Fund, K22
Current Position: Instructor, OHSU

2013- Anja Deutzmann, PhD, Post-Doctoral Fellow, Lymphoma Foundation Fellow

2014-	Arvin Gouw, PhD, NIH T32 Fellowship Current Position: Instructor, Stanford University
2015-2018	Srividya Swaminathan, PhD, Post-Doctoral Fellow. LLS Special Fellow Current Position: Assistant Professor, City of Hope
2016-2021	Renu Dhanasekaran, MD, Instructor, Gastroenterology, TRAM, AGA, K08, ARTS Current Position: Assistant Professor, Stanford University
2017-	Wadie Fernandez, PhD, TRAM
2017-2019	Sibu Kuruvilla, PhD, NIH T32 Fellow Current Position: Manager, Genentech
2017-2019	Minsoon Kim, PhD
2018-2021	Christina Kim, PhD, NIH T32
2019-2021	Aida Hansen, PhD, Denmark Fellowship
2021-	Danielle Atibalentja, MD PhD, Heme Fellow, ASH Scholar
2021-	Alessia Felici, PhD
2021-	Xinyu Chen, PhD
2021-	Petronela Bulga, PhD

<u>Graduate Student Committees</u>

Orals Committees

2002 Rebecca Begley, Dr. Mochly-Rosen Laboratory, Molecular Pharmacology
2002 Joshua T. Jones, Dr. Meyer Laboratory, Molecular Pharmacology
2003 Jacob Chudnovksy, Dr. Kharvari Laboratory, Cancer Biology
2003 Ryan B. Corcoran, Dr. Scott Laboratory, Cancer Biology
2004 Shelly Beer, Cancer Biology
2004 Constandina Arvanitis, Molecular Pharmacology
2004 Tom Johnson, Dr. Attardi Laboratory, Cancer Biology
2004 William Wong, Dr. Cleary Laboratory, Cancer Biology
2005 John Garcia, Dr. Khavari Laboratory, Cancer Biology
2006 Lauren Woodward, Cancer Biology
2007 Alper Yetil, Cancer Biology
2007 Kavya Rakhra, Immunology
2007 Peter Choi, Immunology
2011 Magdalena Franco, Microbiology and Immunology
2012 Joanna Kavalski, Cancer Biology
2016 Kayvon Pedram, Chemistry
2017 Benjie Smith, MSTP
2017 Stan Shor, MSTP
2020 Bastian Krenz, ChEM-H
2021 Andrea Garofalo, MSTP

Dissertation Committees

2002 Joon Whan Rhee, Dr. Cleary Laboratory, Immunology (Chair)
2003 Ryan Corcoran, Dr. Scott Laboratory, Cancer Biology
2003 Rebecca Begley, Dr. Mochly-Rosen Laboratory, Molecular Pharmacology
2003 Joshua T. Jones, Dr. Meyer Laboratory, Molecular Pharmacology
2006 Ryan Corcoran, Dr. Scott Laboratory, Cancer Biology
2007 Yakov Chudnovsky, Dr. Khavari Laboratory, Cancer Biology
2007 Thomas Johnson, Dr. Scott Laboratory, Cancer Biology

2007 Shelly Beer, Dr. Felsher Laboratory, Cancer Biology
2007 Lauren Woodward, Dr. Shapiro Laboratory, Cancer Biology
2007 Constadina Arvanitis, Felsher Laboratory, Cancer Biology
2008 Zhuang Liu, Dr. Dai Laboratory, Chemistry
2008 Meaghan Wall, Melbourne School of Graduate Research
2011 Sarah Sherlock, Dr. Dai Laboratory, Chemistry
2011 Kavya Rakhra, Dr. Felsher Laboratory, Immunology
2011 Alper Yetil, Dr. Felsher Laboratory, Cancer Biology
2011 Peter Choi, Dr. Felsher Laboratory, Immunology
2014 Magdalena Franco, Boothroyd Laboratory, Microbiology and Immunology
2021 Andrea Garofalo, Ash Alizadeh Laboratory, Cancer Biology
2021 Benjamin Smith, Carolyn Bertozzi Laboratory, Chemistry

Editorial Board
2008- Cancer Biology and Therapy
2009- Journal of Clinical Investigation
2009- Chinese Journal of Cancer
2010- Cancer Research
2010- Hematology Oncology
2010- OncoTarget
2010 Cancer Research, Associate Editor of Breaking Advances
2010- International Journal of Oncology
2012- OncoImmunology – Journal of the European Academy of Tumor Immunology
2012- Oncogene, Nature Publishing Group, Senior Editor
2013- Cancer Immunology Research – AACR Journal
2013- Cancer Hallmarks
2018- Cancer Research, Senior Editor

Invited Journal Reviews
American Journal of Pathology
American Journal of Pharmacogenomics
Blood
Breast Cancer Research
Cancer Research
Cancer Cell
Cancer Discovery
Cell
Cell Metabolism
Cell Systems
Cell Stem Cell
Clinical Cancer Research
Current Immunology
eLife
EMBO
Experimental Cell Research
Gastroenterology
Genes and Development
Journal of Clinical Investigation
Journal of National Cancer Institute

Lancet
Leukemia
Molecular Cancer Research
Molecular and Cellular Biology
Molecular Cell
Nature
Nature Biotechnology
Nature Cancer
Nature Chemistry
Nature Communications
Nature Genetics
Nature Medicine
Nature Reviews of Cancer
Oncogene
PLoS Genetics
PLoS One
Proceedings of the National Academy of Sciences
Science
Science Translational Medicine
Trends in Genetics
Trends in Molecular Medicine

<u>NIH Study Sections</u>

2000	NIH Ad Hoc, Review K08s
2004	NIH Site Visit, Hospital University of Pennsylvania
2005	NIH Experimental Therapeutics B Cluster
2006	NIH Clinical and Molecular Oncology Cluster
2006	NIH Clinical and Molecular Oncology Cluster
2007	NIH Molecular Carcinogenesis Study Section
2008	NIH Molecular Carcinogenesis Study Section
2010	NIH Molecular Oncology Study Section
2010	NIH Nanomedicine Development Center
2017	NIH Integrative Cancer Biology Program Special Study Section
2020	NIH NCI SPORE Review
2020	NIH SBIR Review, Co-Chair
2021	NIH NCI Program Projects
2021	NIH NCI Mechanisms of Cancer Therapeutics
2021	NIH 10 MCT2 Mechanisms of Cancer Therapeutics
2022	NIH NCI R35 Outstanding Investigator Award

<u>NIH Intramural Review</u>

2011	NIH Laboratory of Pathology
2011	NIH Laboratory of Pathology Core Facilities
2016	NIH Laboratory of Pathology

<u>National Service</u>

2005	Organizational Committee American Association for Cancer Research
2006	Organizational Committee, American Society for Clinical Oncology
2006	Organizational Committee. European Society of Hematology

2007	Organizational Committee, American Society for Hematology
2007	Organizational Committee, American Association for Cancer Research
2007	Organizational Committee, American Society for Clinical Oncology
2008	Sub-Committee Chair, American Association of Cancer Research
2011	Sub-Committee Chair, American Association of Cancer Research
2013-	AACR Clinical and Translational Cancer Research Grants Scientific Review
2014	Organizational Committee, RECOMB Meeting
2015	Co-Chair, American Associate of Cancer Research, Conference of MYC oncogene
2016	Organizational Committee, RECOMB Meeting
2016	Organizational committee, Chair, Mini-Symposia, AACR
2019	Organizational committee, Chair, Mini-Symposia, AACR
2021-2022	AACR Basic Cancer Research Grants Scientific Review Committee

Program Reviews

2009	Review Panel: UCSF BMS Graduate Program

Scientific Advisory Boards

2007-2010	Cell Biosciences, Palo Alto, California
2013-	American Gene Therapeutics, Rockville, Maryland
2016-2020	Tragara Therapeutics, Carlsbad, California
2017-	Molecular Decisions, California
2017-	Apostle, California
2018-	J Michael Bishop Institute, Chengdu, China
2019-	Bacchus

Search Committees

2009	Chief of Infectious Disease, Department of Medicine
2010	Canary Early Detection Institute/Molecular Imaging Program
2010-	Medical Oncology, Lymphoma Program
2013	Medical Oncology, Melanoma Program
2013	Canary Center
2014	Medical Oncology, Head and Neck Program
2015	Canary Center
2016-	Canary Center
2018-	Medical Oncology, UTL Search

Honors, Awards and Memberships:

Honors

1985	Honors, Chemistry, University of Chicago
1992	Emil Bogen Research Award for Excellence in Science
2002	Charles Carrington Prize in Molecular Mechanisms of Disease

Awards

1985-1992	Medical Scientist Training Program, UCLA
1996-1998	Pfizer Medical Post-Doctoral Fellowship
1996-1998	Lymphoma Research Foundation Fellowship

1997-1999	Howard Hughes Medical Institute, Medical Post-Doctoral Fellowship
1998-2003	NIH Physician Scientist Award (K08 CA75967)
1999-2001	Pilot Feasibility Grant, UCSF Liver center
2000-2001	ASCO Young Investigator Award
2000-2001	Office of Technology Licensing Research Incentive Fund
2000-2002	V Foundation Scholar Award
2000-2003	Esther Ehrman Lazard Faculty Scholar Fund
2000-2001	Stanford Cancer Council Award
2001-	National Cancer Institute (R01 CA89305)
2001-2002	Leukemia Research Foundation Fellowship Award
2001-2002	Lymphoma Research Foundation Junior Faculty Award
2002-2003	Elsa U. Pardee Foundation
2002-2003	Pilot Feasibility Grant, Digestive Disease Consortium at Stanford University
2003-2004	Sarcoma Foundation of America
2003-2008	Damon Runyon-Lilly Clinical Investigator Award
2003-2006	Emerald Foundation Research Award
2003-2006	The Leukemia & Lymphoma Society Translational Research Award
2003-2008	National Cancer Institute (R01 CA105102)
2004-2007	National Cancer Institute (P20 CA112973)
2005-	National Cancer Institute (ICMIC P50 CA114747)
2005-2011	Burroughs Wellcome Fund Translational Investigator Award
2005-2011	National Cancer Institute (U54 CA119367)
2005-	Elected to American Society of Clinical Investigation
2006-2011	National Cancer Institute (P01 CA034233)
2006-2008	The Leukemia & Lymphoma Society
2006-2008	Bio-X Interdisciplinary Initiatives Award
2009-2012	Department of Defense Award
2011	Elected to the Association of American Physicians
2012-2016	NIH R01 Provocative Question Award
2014-2019	NIH U01 (CA188383)
2014-2019	NIH R01 (CA184384)
2015-2020	NIH T32 Training Grant, Department of Radiology
2017-2022	NIH RO1 Provocative Question Award
2021-2027	NIH R35 Outstanding Investigator Award

<u>Memberships</u>

1994-	American College of Physicians
1995-	American Medical Association
1996-	American Society for Clinical Oncology
1998-	American Society for Cell Biology
2000-	American Society of Hematology
2000-	American Association of Cancer Research
2001-	American Society of Gene Therapy
2005-	American Society of Clinical Investigation
2009-	American Gastroenterological Association
2011-	Association of American Physicians
2011-	European Academy for Tumor Immunology (EATI)

Major Invited Addresses

1. Felsher, D. W. Cancer Revoked: Oncogenes as Therapeutic Targets. Charles Carrington Award Lecture. Stanford University, September 2003.

2. Felsher, D. W. Cancer Revoked: Oncogenes as therapeutic targets. Grand Rounds, Stanford University, Department of Medicine, Stanford, California, November 20, 2003.

3. Felsher, D. W. Reversing oncogene induced tumorigenesis. XV Zentrum Molecular Biology Heidelberg FORUM, Heidelberg, Germany, May 7-9, 2004.

4. Felsher, D. W. Co-Chair: Major Symposium: The malignant phenotype: Stability and reversibility. American Association of Cancer Research Annual Meeting, Orlando, Florida, March 27, 2004.

5. Felsher, D. W. Chair of Major Symposia: Oncogenes and tumor suppressor genes: Tumor biology in the clinic. American Society of Clinical Oncology Annual Meeting, Orlando Florida, May 13-17, 2005.

6. Felsher, D. W. Reversing Tumorigenesis. 100th Birthday Korea University Symposium, Seoul, Korea, November 3, 2005.

7. Felsher, D. W. Pushing cancer to the brink of normalcy through oncogene inactivation. Joint Graduate Symposium, Cell Fate Decisions in Health and Disease, University of Wuerzburg, Germany, November 8, 2005.

8. Felsher, D. W. Modeling Oncogene Addiction, Nobel Symposia, Karolinska Institutet, Stockholm, Sweden, 2012

Research Support:

Ongoing

Revolution Medicines 07/01/17-08/29/22

"Therapeutics in the mTor Pathway"

The goal is to identify a novel Tor pathway drug for the treatment of cancer.

NIH 1T32CA196585-01 Rao/Felsher (co-PI) 08/01/15-07/31/22
"Cancer-Translational Nanotechnology Training Program"

The Goal of this program is to train cancer biologist in nanotechnology.

Bio-X, Felsher (PI) 10/01/18-09/30/22

"Imaging changes in immune surveillance by natural killer (NK) cells during the progression of MYC oncogene-driven lymphomas"

Goals: The goal is study mechanisms of NK immune surveillance.

NIH 1KL2TR003143, Felsher (Mentor) 07/15/19-06/30/24

“Institutional Career Development Core (KL2)

Goal is to function as a senior faculty mentor for the training of junior faculty.

NIH R35 Felsher (PI) 09/08/20-8/31/27
“Targeting the MYC Pathway for the Treatment of Cancer”

The goal is to develop a translational research program to study the MYC pathway.

Earli, Inc., Felsher (PI) 03/18/21-03/17/22
“Early Detection of Cancer”

The goal of the Earli grant is to develop a PET imaging prove for the early detection of cancer.

Pepper Bio, Felsher (PI) 10/01/21-09/30/22
“Phosphoproteomic Examination of Oncogene Pathways”

The goal of this project is to use novel computational biological approaches to identify phoshphoproteomic signatures of cancer.

<u>Completed</u>

ASCO Young Investigator Award Felsher (PI) 07/01/00-06/30/01
“Defining When MYC Inactivation Results in the Regression of Hepatoma”

The goal of this study was to investigate if MYC inactivation induces the regression of hepatoma.

Lymphoma Research Foundation of America, Inc. Felsher (PI) 07/01/01-06/30/02
“MYC’s Role in Human Lymphomagenesis”

The major goal of this project was to determine if MYC induces reversible tumorigenesis in human lymphocytes.

Leukemia Research Foundation Felsher (PI) 07/01/01-06/30/02
“Targeting MYC Inactivation for the Treatment of Lymphoma”

The major goal of this project was to define how MYC inactivation causes the regression of hematopoietic tumors.

The V Foundation Felsher (PI) 08/01/00-07/31/02
“The Role of the MYC Proto-Oncogene in The Initiation and Maintenance of Tumorigenesis”

The major goal of this project was to examine how MYC activation cooperates with other oncogenes to induce neoplasia.

Elsa U. Pardee Foundation Felsher (PI) 11/01/01-02/28/03
"Defining when MYC will be an Effective Target for the Therapy of Cancer"

The major goal of this project was to investigate MYC's role in the induction and maintenance of a neoplastic phenotype in human lymphomas.

Digestive Disease Center Felsher (PI) 03/01/02-02/28/03
"MYC's Role in the Induction of Hepatocellular Carcinoma"

The focus of this project was to study the role of the MYC oncogene in the induction of hepatocellular carcinoma.

NIH/NCI 5K08 CA75967-02 Felsher (PI) 09/01/98–08/31/03
"C-MYC Induced Tumorigenesis and Genomic Instability"

The major goal of this project was to investigate how MYC induces genomic destabilization.

Sarcoma Foundation of American Felsher (PI) 04/01/03-03/31/04
"Targeting the Inactivation of the MYC Oncogene to Treat Osteogenic Sarcoma"

The goal of this project was to develop a new treatment for osteosarcoma.

3R01 CA89305-03S1 NOT-CA-03-017 Felsher (PI) 06/01/03-05/31/04
NIH/NCI (Supplemental)
"MYC's Role in the Initiation and Maintenance of Cancer"

The goal of this project was to define the role of immune-mediated mechanisms in the suppression of MYC-induced tumorigenesis.

Emerald Foundation Felsher (PI) 07/01/03-06/30/06
"Determining when Brief MYC Inactivation will Reverse Tumorigenesis"

The major goal of this proposal was to evaluate the duration of MYC oncogene inactivation required to result in sustained regression of hematopoietic tumors.

The Leukemia & Lymphoma Society Felsher (PI) 10/01/03-9/30/06
"Inactivating MYC for the Treatment of Lymphoma"

The goal of this project was to pre-clinically evaluate a new anti-sense drug that targets MYC in our transgenic animal model of lymphoma.

Ludwig Translational Program Cancer Research Felsher (PI) 11/01/04-10/31/06
"Phosphoprotein Signatures that Define the Therapeutic Efficacy of Atorvastatin for the Treatment of Lymphoma"

The major goal was to study phosphoprotein signatures in tumors treated with statins.

The Leukemia & Lymphoma Society Felsher (PI) 10/01/06-9/30/08
"A Phase 1 Study of Atorvastatin in Patients with Low Grade or Refractory Non-Hodgkin's Lymphoma"

The goal of this project is to pre-clinically evaluate atorvastatin for the treatment of lymphoma.

Bio-X Interdisciplinary Initiatives Award Felsher (PI) 10/01/06-09/30/08
"Carbon Nanotube Mediated Therapy of Lymphoma"

The goal of this project is to develop novel therapies for the treatment of lymphoma.

Damon Runyon Cancer Research Foundation Felsher (PI) 07/01/03-12/31/08
"Targeting MYC for the Treatment of Lymphoma"

The goal of this project is to perform a phase I/II trial to evaluate a new anti-sense drug that targets MYC for the treatment of lymphoma.

NIH/NCI 1R01 CA105102 Felsher (PI) 02/01/04-01/31/09
"Differentiation of Osteogenic Sarcoma By MYC Inactivation"

The goal of this project is to study how MYC inactivation induces the differentiation of osteogenic sarcoma in a transgenic mouse model.

NIH/NCI U56 CA112973 Plevritis (PI) 03/01/10-08/31/10
"Computational Modeling of Cancer Biology"

The goal of this project is to develop a multi-disciplinary research program in the systems biology of cancer. Dr. Felsher is a co-investigator receiving 5% effort and some laboratory support.

NIH/NCI U54 CA119367 Gambhir (PI) 05/12/06-04/30/11
Co-Leader Project 4 and 6
"Centers of Cancer Nanotechnology Excellence on Therapy Response"

The goal s of these projects are to apply nanotubes towards the development of novel therapies for cancers. Dr. Felsher is a co-investigator on two of the projects to pre-clinically evaluate nanotechnology in animal models.

Burroughs Wellcome Fund Felsher (PI) 07/01/05-06/30/11
Clinical Translational Award
"Pre-Clinical Validation of G-Quadruplex Drugs that Target MYC to Treat Cancer"

The major goal of this project is to perform a preclinical validation in transgenic mouse models of the role of G-Quadruplex drugs for the inactivation of the MYC oncogene for the treatment of cancer.

NIH R01 CA105102-05A1 Felsher (PI) 07/17/09-07/16/11
"Molecular and Cellular Basis of Oncogene Addiction"

The goal of this project is to define the mechanism by which oncogene inactivation elicits the phenomena of oncogene addiction.

NIH/NCI 2R01CA89305 Felsher (PI) 05/01/07-02/29/12

"MYC's role in the Initiation and Maintenance of Cancer"

The objective of the project is to define how MYC contributes to tumorigenesis by identifying and then interrogating how the repair of specific genetic events, such as p53

mutation restores the ability of MYC inactivation to induce sustained tumor regression through influences on proliferation, apoptosis and angiogenesis.

NIH/NCI P01 CA034233 (NCX) Levy (PI) 07/17/06-03/31/12
"Clinical and Laboratory Studies of Malignant Lymphoma"
Project Leader Project 3 "Immune Status and Tumor Regression Upon Oncogene Inactivation"

The goal of this project is to examine the contribution of the immune system and specific immune effector pathways in tumor regression upon MYC inactivation.

DOD CDMRP Felsher (PI) 04/15/09-04/14/12
"Nanoscale Proteomic Analysis of Oncoproteins in Hematopoietic Cancers"

The goal of this project is to develop novel methods to examine the oncogenic proteomic signaling pathways in hematopoietic cancers in response to therapy.

NCI 2P30CA124435-04 Mitchell (PI) 09/15/10-05/31/15
Stanford University Cancer Center

The major goal of this project is to build on institutional strengths in both technology development and translational research to foster interdisciplinary collaborations.

Onyx Pharmaceutical Corporation 108030 Felsher (PI) 06/17/12-12/16/12
"Defining and Predicting Carfilzomib activity using Novel Nanoscale Proteomic Methods in Preclinical Transgenic models of Lymphoma and Lung Cancer"

The goal of this project is to interrogate mechanism of carfilzomib using mouse models.

Onconova Therapeutics, Inc. Felsher (PI) 05/01/12-04/30/13
"Biomarker Analysis of MDS"

The goal of this project is to identify phosphoproteins that predict therapeutic response to a novel therapy for hematopoietic malignancies.

Laurel Foundation Felsher (PI) 12/01/10-05/31/13
"Identification of a rare population of human embryonic stem cells having potential tumorigenic activity following exposure to hypoxia oxidative stress"

The goal of this project is to characterize the role of oncogenes in the regulation of stem cell programs.

LLS Specialized Center of Research Grant Mitchell (PI) 10/01/08-09/30/13
"Characterization of Hematopoietic Stem Cells in Myelodysplastic Syndromes"
"Molecular and Cellular Characterization of Myelodysplastic Syndromes" Core D: (D. Felsher)

The goal of this project is to perform genomic/proteomic analysis of MDS/Leukemia specimens.

Geron Corporation Felsher (PI) 07/01/10-12/31/13
"Evaluation of Inhibitors or Regulators of c-MYC for the Treatment of Malignancies"

The Goal of this project is to develop a novel therapeutic agent.

NIH/USC U54 CA143907 Agus (PI) 08/01/12-07/31/14
"Multiscale Complex Systems Transdisciplinary Analysis of Response to Therapy (MCSTART)"

The goal of this project is to model and predict the therapeutic response of lymphoma to a chemotherapeutic agent.

Massachusetts Institute of Technology Felsher (PI) 08/01/12-07/31/14
(NIH PRIME) NIH/NCI U54 CA143874
"Defining and Predicting Response to Targeted Therapy Using Dry Density Measurement"

The goal is to utilize a novel nanofluidic to predict consequences of oncogene inactivation.

Onconova Therapeutics, Inc. #106824 Felsher (PI) 05/01/12-10/31/14
"Biomarker Analysis of MDS"
The goal of this project is to identify phosphoproteins that predict therapeutic response to a novel therapy for hematopoietic malignancies.

Regulus Therapeutics, Inc. Felsher (PI) 01/28/13-05/31/15
"Identification and Evaluation of Myc Regulated MicroRNAs as Potential Therapeutic Targets"
The purpose of this study is to examine the role of microRNA in the pathogenesis of MYC associated tumorigenesis.

NIH/NCI R21 CA169964 Felsher (PI) 08/01/12-07/31/15
"Nanoscale Proteomic Profiles of Hypoxia Pathways to Develop Biomarkers of Renal Cell Carcinoma"

This proposal is to develop prognostic and predictive proteomic biomarkers for primary and metastatic renal cell carcinoma using NIA technology to profile hypoxia pathways.

Onconova Therapeutics, Inc. #114321 Felsher (PI) 01/01/14-07/31/15
"Phase I Study of Platinum-based Chemoradiotherapy (CRT) with Oral Rigosertib in Patients with Intermediate or High-risk Head and Neck Squamous Cell Carcinoma"

Onconova Therapeutics, Inc. #110214 Felsher (PI) 03/01/13-08/31/15
NIA correlative studies of Oral Rigosertib in SCC

NIH/NCI ICMIC P50 CA114747 Gambhir (PI) 08/01/05-08/31/15
"In Vivo Cellular and Molecular Imaging Center Grant"
Project 3 Leader: "Multi-Modality Imaging of Oncogene-Induced tumorigenesis"

The objective is to utilize PET imaging to investigate the mechanism by which oncogene inactivation induces the regression of hematopoietic tumor.

Sanofi-Aventis, US, Inc./BioStar Felsher (PI) 12/10/12-12/09/15
"Prediction of Therapeutic Efficacy of Targeted Oncogene Inactivation via PET Imaging Using a Novel Smart Apoptosis Probe ([18F] CAIP)"

The goal of this project is to develop a novel approach for predicting the consequences of oncogene inactivation.

NIH/NCI ICBP CCSB U54 CA149145 Plevritis (PI) 05/01/10-02/29/16
Modeling the Role of Differentiation in T-ALL, Murine and Human
Project Leader Project 4: "Modeling the Role of Differentiation in Cancer Progression"

The goal of the Stanford Center for Systems Biology of Cancer (CCSB) is to discover molecular mechanisms underlying cancer progression.

NIH/NCI CCNE-T U54 CA151459 Gambhir (PI) 08/26/10-07/31/16
"Magneto-Nano Diagnostic and Analytical Devices for Cancer"
Project 2-(Wang/Felsher) Proteomic Validation of Micro-Chip Assay

The major goal of this project is to apply novel nanoscale diagnostic devices for the detection and monitoring of cancer.

Cancer Research Institute CLIP grant Felsher (PI) 07/01/14-06/30/17
"Oncogene addiction and immune activation"

The goal is to examine the mechanistic role of CD4+ T-cells in Oncogene Addiction.

Onkaido Therapeutics #119779 Felsher (PI) 03/25/15-06/30/17
"C-MYC Collaboration"

The Goal is to evaluate a novel therapy for liver cancer.

American Gene Technologies International Inc. Felsher (PI) 05/01/15-06/30/17
"HCC Lentiviral Therapeutic"

The goal is to develop a new therapeutic delivery approach for treatment of HCC.

NIH/NCI CCNE-T U54 CA151459 Gambhir (PI) 08/26/10-07/31/17
"Magneto-Nano Diagnostic and Analytical Devices for Cancer"
Project 2-(Wang/Felsher) Proteomic Validation of Micro-Chip Assay

The goal of this project is to apply novel nanoscale diagnostic devices for the detection and monitoring of cancer.

NIH/NCI R01 CA170378 PQ22 Felsher (PI) 08/01/12-07/31/17
"Mechanisms by Which Oncogene Inactivation Elicits Tumor Cell Death"

The goal of this study is to identify the mechanistic basis of cell death upon oncogene inactivation.

Tragara Pharmaceuticals, Inc., Felsher (PI) 07/01/16-06/30/17
"K9 Inhibitor Collaboration 2016"

This project investigators a novel CD inhibitor for cancer.

Apostle, Inc. 10/01/17-07/31/18

"Capturing Genetic Signature of Hepatocellular Carcinoma Through Liquid Biopsy with a Novel MiniMax Technology: a Pilot Study"

The goal is to identify a unique prognostic gene signature for liver cancer.

Roche TCRC, Inc. Felsher (PI) 09/01/16-02/28/19
"Investigation of Therapeutic Activity of RG6416"

The goal of this project is to study the mechanism of action of novel therapeutics.

Emerson Collective Cancer Research Fund, Felsher (PI) 04/01/17-03/31/19
"Identifying Small Molecules That Can Restore a Global Immune Response Against Cancer"

The goal is to identify new therapeutics to restore the immune response against cancers.

NIH R01 CA184384 Felsher/Zare (PI) 04/04/14-08/31/19
"Prognostic metabolic signatures of cancers through mass spectrometry imaging"

The goal of this project is to utilize DESI MS Imaging to determine the mechanistic role of MYC mediated regulation of lipid metabolism in tumorigenesis.

NIH U01 CA188383 Felsher/Gambhir (PI) 09/16/14-08/31/19
"Modeling and Predicting Therapeutic Resistance of Cancer"

The goal of this project is mathematically model how the immune system is involved in therapeutic resistance in T-cell acute lymphoblastic lymphoma.

Alligator Bioscience Felsher (PI) 09/03/14-09/02/19
"Development of Bispecific Immune Modulating Antibodies"

The goal of this project is to predict efficacy of novel immune therapeutics.

Sanofi US Services, Inc., Felsher (PI) 12/24/19-12/23/21

"Lipogenesis inhibition in cancer"

Goals: The goal of this study is to identify novel targets in the lipogenesis pathway to treat cancer.

Publications:

Chapters (total of 3)

121. Arvanitis, C., Bendapudi, P. K., Bachireddy, P., and Felsher, D. W. Identifying critical signaling molecules for the treatment of cancer. Recent Results in Cancer Research, Vol. 172, Springer-Verlag Berlin Heidelberg 2007.

122. Bellovin, D.I., Das, B., and Felsher D.W. Tumor Dormancy, Oncogene Addiction, Cellular Senescence, and Self-Renewal programs. Systems Biology of Tumor Dormancy, pp 91-107, Part of the Advances in Experimental Medicine and Biology book series (AEMB, Vol. 734), Springer Link 2012.

123. Felsher, D.W., Arvanitis, C., Bendapudi, P., and Bachireddy, P. Oncogenes and the initiation and maintenance of tumorigenesis. Northwestern University | Northwestern Scholars, The Molecular Basis of Human Cancer, pp 143-157, Springer New York 2016.

Peer-reviewed articles (total of 124)

1. Welches, W., Felsher, D. W., Landshultz, W., and Maraganore, J. M. A rapid method for the purification of monomeric and/or dimeric phospholipases in crotalid snake venoms. Toxicon, 23(5): 747, 1985.

2. Felsher, D. W., Denis, K., Weiss, D., Ando, D. T., and Braun, J. A murine model of B-cell lymphomagenesis in immunocompromised hosts: C-MYC rearranged B-cell lines with a premalignant phenotype. Cancer Research, 50(21): 7042, 1990.

3. Felsher, D. W., Rhim, S., and Braun, J. A murine model for B-cell lymphomagenesis in immunocompromised hosts: Natural killer cells are an important component of host resistance to premalignant B-cell lines. Cancer Research, 50(21): 7050, 1990.

4. Felsher, D. W., Ando, D., and Braun, J. Independent rearrangement of Ig lambda genes in tissue culture-derived murine B-cell lines. International Immunology, 3(7): 711, 1991.

5. Goodglick, L. A., Felsher, D. W., Mehran, N., and Braun, J. A novel octamer regulatory element in the VH11 leader exon of B-1 cells. Journal of Immunology, 154(9): 4546, 1995.

6. Felsher, D. W., and Bishop, J. M. Transient excess of MYC activity can elicit genomic instability and tumorigenesis. Proceedings of the National Academy of Sciences, 96(7): 3940, 1999.

7. Felsher, D. W., and Bishop, J. M. Reversible tumorigenesis by MYC in hematopoietic lineages. Molecular Cell, 4(2): 199, 1999.

8. Felsher, D. W., Zetterbert, A., Zhu, J., Tlsty, T., and Bishop, J. M. Overexpression of MYC causes p53-dependent G2 arrest of normal fibroblasts. Proceedings of the National Academy of Sciences, 97(19): 10544, 2000.

9. Johansen, L. M., Iwama, A., Lodie, T. A., Sasaki, K., Felsher, D. W., Golub, T. R., and Tenen, D. G. c-Myc is a critical target for C/EBP & in Granulopoiesis. Molecular and Cellular Biology, 21(11): 3789, 2001.

10. Jain, M., Arvanitis, C., Chu, K., Dewey, W., Leonhardt, E., Trinh, M., Sundberg, C. D., Bishop, J. M., and Felsher, D. W. Sustained loss of a neoplastic phenotype by brief inactivation of MYC. Science, 297(5578): 102, 2002. Also see: I. Bernard Weinstein, Addiction to oncogenes—The achilles heal of cancer. Science, 297: 63, 2002.

11. Karlsson, A., Giuriato, S., Tang, F., Fung-Weier, J., Levan, G., and Felsher, D. W. Genomically complex lymphomas undergo sustained regression upon MYC inactivation unless they acquire chromosomal translocations. Blood, 101(7): 2797, 2003. Also see K. Shannon, Bypassing the requirement for MYC in lymphoma progression. Blood, 101(7): 2451, 2003.

12. Karlsson, A., Deb-Basu, D., Cherry, A., Turner, S., Ford, J., and Felsher, D. W. Defective double-strand DNA break repair and chromosomal translocations by MYC overexpression. Proceedings of the National Academy of Sciences, 100(17): 9974-9979, 2003. Also see: E. Greenwood, Oncogenes: One-man band, 3: 714, 2003.

13. Yang, Y, Contag, C. H., Felsher, D. W., Shachaf, C. M., Cao, Y, Herzenberg, L. A., Herzenberg, L. A., and Tung, J. W. The E47 transcription factor negatively regulates CD5 expression during thymocyte development. Proceeding of the National Academy of Sciences, 101(11): 3898-3902, 2004.

14. Baron, B. W., Anastasi, J., Montag, A., Huo, D., Baron, R. M., Karrison, T., Thirman, M. J., Subudh, S. K., Chin, R. K., Felsher, D. W., Fu,Y., McKeithan, T. W., and Baron, J. M. The human BCL6 transgene promotes the development of lymphomas in the mouse. Proceeding of the National Academy of Sciences, 101(39): 14198-14203, 2004.

15. Beer, S., Zetterberg, A., Ihrie, R. A., Yang, Q., Bradon, N., Arvanitis, C., Attardi, L. D., Ruebner, B., Cardiff, R. D., and Felsher, D. W. Developmental context determines latency of MYC induce tumorigenesis. PLOS Biology, 2(11): e332, 2004.

16. Shachaf, C. M., Kopelman, A., Arvanitis, C., Beer, S, Karlsson, A., Mandl, S., Bachmann, M. H., Borowsky, A. D., Ruebner, B., Cardiff, R. D., Yang, W., Bishop, J. M., Contag, C. H., and Felsher, D. W. MYC inactivation uncovers pluripotent differentiative properties and induces a state of tumor dormancy in hepatocellular cancer. Nature, 431(7012): 1112-7, 2004. Also see: E. Hutchinson, Nature Reviews Cancer 7:834, 2004.

17. Sander, S., Bullinger, L., Karlsson A., Giuriato S., Hernandez-Boussard, T., Felsher, D. W., and Pollack J. R. Comparative genomic hybridization on mouse cDNA microarrays and its application to a murine lymphoma model. Oncogene, 24(40): 6101-7, 2005.

18. Beverly, L. J., Felsher, D. W., and Capobianco, A. J. Suppression of p53 by notch in lymphomagenesis: implications for initiation and regression. Cancer Research 65(16): 7159-68, 2005.

19. Kwon, H., Ogle L., Benitez, B., Bohuslav, J., Montano M., Felsher, D. W., and Greene, W. C. Lethal cutaneous disease in transgenic mice conditionally expressing type I human T cell leukemia virus Tax. Journal of Biological Chemistry, 280(42): 35713-22, 2005.

20. Deb-Basu, D., Aleem, E., Kaldis, P., and Felsher, D. W. CDK2 is required by MYC to induce apoptosis. Cell Cycle, 5(12): 1342-7, 2006.

21. Deb-Basu, D., Karlsson, A., Li, Q., Dang, C. V., and Felsher, D. W. MYC can enforce cell cycle transit from G1 to S and G2 to S, but not mitotic cellular division, independent of P27 inhibition of cyclin E/CDK2. Cell Cycle, 5(12): 1348-55, 2006.

22. Ray, S., Atkuri, K. R., Deb-Basu, D., Adler, A. S., Chang, H. Y., Herzenberg, L. A., and Felsher, D. W. MYC can induce DNA breaks in vivo and in vitro independent of ROS. Cancer Research, 66(13): 6598-605, 2006.

23. Weng, A. P., Millholland, J. M., Yashiro-Ohtani, Y., Arcangeli, M. L., Lau, A., Wai, C., del Bianco, C., Rodriguez, C. G., Sai, H., Tobias, J., Li, Y., Wolfe, M. D., Shachaf, C., Felsher, D. W., Blacklow, S. C., Pear, W. S., and Aster, J. C. cMyc is an important direct target of Notch1 in T cell acute lymphoblastic leukemia/lymphoma. Genes and Development, 20(15): 2096-109, 2006.

24. Giuriato, S., Ryeom, S., Fan, A. C., Bachireddy, P., Lynch, R. C., Rioth, M. J., van Riggelen, J., Kopelman, A. M., Passegue, E., Tang, F., Folkman, J., and Felsher, D. W. Sustained regression of tumors upon MYC inactivation requires p53 or TSP-1 to reverse the angiogenic switch. Proceedings of the National Academy of Sciences, 103(44): 16266-71, 2006.

25. Pan, M., Winslow, M. M., Chen, L., Kuo, A., Felsher, D. W., and Crabtree, R. Enhanced NFATc1 nuclear occupancy causes T cell activation independent of CD28 costimulation. Journal of Immunology, 178(7): 4315-21, 2007.

26. Arvanitis, C., Bendapudi, P. K., Bachireddy, P., and Felsher, D. W. Identifying critical signaling molecules for the treatment of cancer. Cancer Research, 172: 5-24, 2007.

27. Shachaf, C., Perez, O. D., Youssef, S., Fan, A. C., Elchuri, S., Goldstein, M. J., Shirer, A. E., Sharpe, O., Chen, J., Mitchell, D. J., Chang, M., Nolan, G. P., Steinman, L., and Felsher, D. W. Inhibition of HMGcoA reductase by atorvastatin prevents and reverses MYC-induced lymphomagenesis. Blood DOI 110(7): 2674-84, 2007.

28. Giuriato, S., Faumont, N., Bousquet, E., Foisseau, M., Bibonne, A., Moreau, M., Al Saati, T., Felsher, D. W., Delsol, G., Meggetto, F. Development of a conditional bioluminescent transplant model for TPM3-ALK-induced tumorigenesis as a tool to validate ALK-dependent cancer targeted therapy. Cancer Biology Therapy, (8): 1318-23, 2007.

29. Wu, C., van Riggelen, J., Yetil, A., Fan, A. C., Bachireddy, P., and Felsher, D. W. Cellular senescence is an important mechanism of tumor regression upon c-Myc inactivation. Proceedings of the National Academy of Sciences, 104(32): 13028-33, 2007.

30. Gao, P., Zhang, H., Dinavahi, R., Li, F., Xiang, Y., Raman, V., Bhujwalla, Z. M., Felsher, D. W., Cheng, L., Pevsnr, J., Lee, L. A., Semenza, G. L., and Dang, C. V. HIF-dependant antitumorigenic effect of antioxidants in vivo. Cancer Cell, 12(3): 230-8, 2007.

31. Opavsky, R., Tsai, S., Guimond, M., Arora, A., Opavska, J., Becknell, B., Kaufmann, M., Walton, N. A., Stephens, J. A., Fernandez, S. A., Muthusamy, N., Felsher, D. W., Porcu, P., Caligiuri, M. A., and Leone, G. Specific tumor suppressor function for E2F2 in Myc-induced T cell lymphomagenesis. Proceedings of the National Academy of Sciences, 104(39): 15400-15405, 2007.

32. Opavsky, R., Wang, S., Trikha, P., Raval, A., Huang, Y., Wu, Y., Rodriguez, B., Keller, B., Liyanarachi, S., Wei, G., Davuluri, R. V., Weinstein, M., Felsher, D. W., Ostrowski, M., Leone, G., and Plass, C. CpG island methylation in a mouse model of lymphoma is driven by the genetic configuration of tumor cells. PLOS Genetics, 3(9): e167, 2007.

33. Omidvar, N., Kogan, S., Beurlet, S., le Pogam, C., Janin, A., West, R., Noguera, M. E., Reboul, M., Soulie, A., Leboeuf, C., Setterblad, N., Felsher, D. W., Lagasse, E., Mohamedali, A., Thomas, N. S., Fenaux, P., Fontenay, M., Pla, M., Mufti G. J., Weissman, I., Chomienne, C., and Padua, R. A. BCL-2 and mutant NRAS interact physically and functionally in a mouse model of progressive myelodysplasia. Cancer Research, 67(24): 11657-6, 2007.

34. Tran, P. T., Fan, A. C., Bendapudi, P. K., Koh, S., Komatsubara, K., Chen, J., Horng, G., Bellovin, D. I., Giuriato, S., Wang, C. S., Whitsett, J. A., and Felsher, D. W. Combined inactivation of MYC and k-ras oncogenes reverses tumorigenesis in lung adenocarcinomas and lymphomas. PLoS One, 3(5): e2125, 2008.

35. Wu, C., Sahoo, D., Arvanitis, C., Bradon, N., Dill, D., and Felsher, D. W. Combined analysis of murine and human microarrays and ChIP analysis reveals genes associated with ability of MYC to maintain tumorigenesis. PLoS Genetics, 4(6): e1000090, 2008.

36. Beer, S., Komatsubara, K., Bellovin, D., Kurobe, M., Sylvester, K., and Felsher, D. W. Hepatotoxin-induced changes in the adult murine liver promote MYC-induced tumorigenesis. PLoS One, 3(6): e2493, 2008.

37. Shachaf, C., Gentles, A., Elchuri, S., Sahoo, D., Soen, Y., Sharpe, O., Perez, O., Chang, M., Mitchel, D., Robinson, W., Nolan, G., Dill, D., Plevritis, S., and Felsher, D. W. Genomic and proteomic analysis reveals a threshold level of MYC required for tumor maintenance. Cancer Research, 68(13): 5132-42, 2008.

38. Traykova-Brauch, M., Schönig, K., Greiner, O., Miloud, T., Jauch, A., Bode, M., Felsher, D. W., Glick, A. B., Kwiatkowski, D. J., Bujard, H., Horst, J., von Knebel Doeberitz, M., Niggli, F. K., Kriz, W., Gröne, H. J., and Koesters, R. An efficient and versatile system for acute and chronic modulation of renal tubular function in transgenic mice. Nature Medicine, 14(9): 979-84, 2008.

39. Fan, A. C., Goldrick, M. M., Ho, J., Liang, Y., Bachireddy, P., and Felsher, D. W. A quantitative PCR method to detect blood microRNAs associated with tumorigenesis in transgenic mice. Molecular Cancer, 7(1): 74, 2008.

40. Arvanitis, C., Bendapudi, P. K., Tseng, J. R., Gambhir, S. S., and Felsher, D. W. (18)F and (18)FDG PET imaging of osteosarcoma to non-invasively monitor in situ changes in cellular proliferation and bone differentiation upon myc inactivation. Cancer Biology and Therapy, 7(12): 1947-51, 2008.

41. Felsher, D. W. Reversing cancer from inside and out: Oncogene addiction, cellular senescence, and the angiogenic switch. Lymphatic Research and Biology, 6(3-4): 149-54, 2008.

42. Ney, J. T., Schmidt, T., Kurts, C., Zhou, Q., Eckert, D., Felsher, D. W., Schorle, H., Knolle, P., Tuting, T., Barchet, W., Buttner, R., Limmer, A., and Gutgemann, I. Autochthonous liver tumors induce systemic T cell tolerance associated with T cell receptor down-modulation. Hepatology, 49(2): 471-81, 2009.

43. Tran, P. T., and Felsher, D. W. The current STATe of biomarkers to predict the response to anti-angiogenic therapies. Cancer Biology & Therapy, 7(12): 2004-6, 2008.

44. Lee, H. G., Casadesus, G., Nunomura, A., Zhu, X., Castellani, R. J., Richardson, S. L., Perry, G., Felsher, D. W., Petersen, R. B., and Smith, M.A. The neuronal expression of MYC causes a neurodegenerative phenotype in a novel transgenic mouse. American Journal of Pathology, 174(3): 891-7, 2009.

45. Kampa, K. M., Acoba, J. D., Chen, D., Gay, J., Lee, H., Beemer, K., Padiernos, E., Boonmark, N., Zhu, Z., Fan, A. C., Bailey, A. S., Fleming, W. H., Corless, C., Felsher, D. W., Naumovski, L., and Lopez, C. D. Apoptosis-stimulating protein of p53 (ASPP2) heterozygous mice are tumor-prone and have attenuated cellular damage-response thresholds. Proceedings of the National Academy of Science USA, 106(11): 4390-5, 2009.

46. Levashova, Z., Backer, M. V., Horng, G., Felsher, D. W., Backer, J. M., and Blankenberg, F. G. SPECT and PET imaging of EGF receptors with site-specifically labeled EGF and Dimeric EGF. Bioconjugate Chemistry, 20(4): 742-9, 2009.

47. Fan, A. C., Deb-Basu, D., Orban, M. W., Gotlib, J. R., Natkunam, Y., O'Neil, R., Padua, R. A., Xu, L., Taketa, D., Shirer, A. E., Beer, S., Yee, A. X., Voehringer, D. W., and Felsher, D. W. Nano-fluidic proteomic assay for serial analysis of oncoprotein activation in clinical specimens. Nature Medicine, 15(15): 566-71, 2009. Also see: G. Alderton, Proteomics: Biomarkers on a nanoscale, Nature Reviews Cancer, 9:382, 2009

48. Liu, Z, Fan, A. C., Rakhra, K., Sherlock, S., Goodwin, A., Chen, X., Yang, Q., Felsher, D. W., and Dai, H. Supramolecular stacking of doxorubicin on carbon nanotubes for in vivo cancer therapy. Angewandte Chemie, 48(41): 7668-72, 2009.

49. Lee, H.G., Chen, Q., Wolfram, J. A., Richardson, S. L., Liner, A., Siedlak, S. L., Zhu, Z., Ziats, N. P., Fujioka, F., Felsher, D. W., Castellani, R. J., Valencik, M. L., McDonald, J. A., Hoit, B. D., Lesnefsky, E. J., and Smith, M. A. Cell cycle re-entry and mitochondria defects in Myc-mediated hypertrophic cardiomyopathy and heart failure. PLoS One, 4(9): e7172, 2009.

50. Beer, S., Bellovin, D. I., Lee, J. S., Komatsubara, K., Wang, L. S., Koh, H., Borner, K., Storm, T. A., Davis, C. R., Kay, A. K., Felsher, D. W., and Grimm, D. Low-level shRNA cytotoxicity can contribute to MYC-induced hepatocellular carcinoma in adult mice (the contribution). Molecular Therapy, 18(1): 161-70, 2009.

51. Giuriato, S., Foisseau, M., Dejean, E., Felsher, D. W., Al Saati, T., Demur, C., Ragab, A., Kruczynski, A., Schiff, C., Delsol, G., and Meggetto, F. Conditional TPM3-ALK and NPM-ALK transgenic micedevelop reversible ALK-positive early B cell lymphoma/leukemia. Blood, 115(20): 4061-70, 2010.

52. Zhou, H., Rodriguez, M., van den Haak, F., Nelson, G., Jogani, R., Xu, J., Zhu, X., Xian, Y., Tran, P. T., Felsher, D. W., Keall, P. J., and Graves, E. E. Development of a MicroCT-Based Image-Guided Conformal Radiotherapy System for Small Animals. International Journal of Radiation Oncology, Biology, Physics, 78(1): 297-305, 2010.

53. van Riggelen J., Müller J, Otto T., Beuger V., Yetil A., Choi P. S., Kosan C., Möröy T, *Felsher D. W., and *Eilers M. The interaction between Myc and Miz1 is required to antagonize TGFbeta-dependent autocrine signaling during lymphoma formation and maintenance. Genes Dev., 24(12): 1281-94, 2010. *co-senior and corresponding authors

54. Woodard, L. E., Keravala, A., Jung, W. E., Wapinski, O. L., Yang, Q., Felsher, D. W., and Calos, M. P. Impact of hydrodynamic injection and phiC31 integrase on tumor latency in a mouse model of MYC-induced hepatocellular carcinoma. PLoS One, 5(6): e11367, 2010.

55. Fan-Minogue H., Cao, Z., Paulmurugan R., Chan C. T., Massoud, T. F., Felsher, D. W., and Gambhir, S. S. From the cover: Noninvasive molecular imaging of c-Myc activation in living mice. Proceedings of the National Academy of Sciences, 107(36): 15892-7, 2010.

56. Graves, E. E., Vilalta, M., Cecic, I. K., Erler, J. T., Tran, P. T., Felsher, D. W., Sayles, L., Sweet-Cordero, A., Thu Le, Q., and Giaccia, A., J. Hypoxia in models of lung cancer: Implications for targeted therapeutics. Clinical Cancer Research, 16(19): 4843-52, 2010.

57. Contag, C. H., Sikorski, R., Negrin, R., Schmidt, T., Fan, A., Bachireddy, P., Felsher, D. W., and Thorne S. H. Definition of an enhanced immune cell therapy in mice that can target stem-like lymphoma cells. Cancer Research, 70(23): 9837-45, 2010.

58. Rakhra, K., Bachireddy, P., Zabuawala, T., Zeiser, R., Xu, L., Kopelman, A., Fan, A. C., Yang, Q., Braunstein, L., Crosby, E., Ryeom, S., and Felsher, D. W. CD4+ T-cells contribute to the remodeling of the microenvironment required for sustained tumor regression upon oncogene inactivation. Cancer Cell, 18(5): 485-98, 2010.

59. Nielsen, C. H., Kimura, R. H., Withofs, N., Tran P. T., Miao, Z., Cochran, J. R., Cheng, Z., Felsher, D. W., Kjaer, A., Willmann, J. K., and Gambhir, S. S. PET Imaging of tumor neovascularization in a transgenic mouse model with a novel 65Cu-DOTA-knottin peptide. Cancer Research, 70(22): 9022-30, 2010.

60. Muller, J., Samans, B., van Riggelen J., Faga, G., Peh, K. N. R., Wei, C. L., Muller, H., Amati, B., Felsher, D. W., and Eilers, M. TGFbeta-dependent gene expression shows that senescence correlates with abortive differentiation along several lineages in Myc-induced lymphomas. Cell Cycle, 9 (23): 4622-4626, 2010.

61. Huang, M., Whang, P., Chodaparambil, J. V., Pollyea, D. A., Kusler, B., Xu, L., Felsher, D. W., and Mitchell, B. S. Reactive oxygen species regulate nucleostemin oligomerization and protein degradation. Journal of Biological Chemistry, 286(13): 11035-46, 2011.

62. Cao, Z., Fan-Minogue, H., Bellovin, D., Arzeno, J., Yang, Q., Gambhir, S. S., and Felsher, D. W. Inhibition of HMG-CoA reductase by statins reverses hepatocellular tumorigenesis by blocking phosphorylation and activation of c-MYC. Cancer Research, 71(6): 2286-97, 2011.

63. Saddic, L. A., Wirt, S., Vogel, H., Felsher, D. W., and Sage, J. Functional Interactions between Retinoblastoma and c-MYC in a Mouse Model of Hepatocellular Carcinoma. PLoS One, 6(5): e19758, 2011. [PubMed - in process] Free PMC Article

64. Dejean, E., Renalier, M. H., Foisseau, M., Agirre, X., Joseph. N., de Paiva, G. R., Al Saati, T., Soulier, J., Desjobert, C., Lamant, L., Prósper, F., Felsher, D. W., Cavaillé, J. Prats, H., Delsol, G., Giuriato, S., and Meggetto, F. Hypoxia-microRNA-16 downregulation induces VEGF expression in anaplastic lymphoma kinase (ALK)-positive anaplastic large-cell lymphomas. Leukemia, doi: 10.1038/leu.2011.168. [Epub ahead of print]

65. Seetharam, M., Fan, A. C., Tran, M., Xu, L., Renschler, J. P., Felsher, D. W., Sridhar, K., Wilhelm, F., and Greenberg, P. L. Treatment of higher risk myelodysplastic syndrome patients unresponsive to hypomethylating agents with ON 01910.Na. Leukemia Research 2011 Sep 14. [Epub ahead of print]

66. Choi, P. S., van Riggelen, J., Gentles, A., J., Bachireddy, P., Rakhra, K., Adam, S. J., Plevritis, S. K., and Felsher, W. D. Lymphomas that recur after MYC suppression continue to exhibit oncogene addition. Proceedings of the National Academy of Sciences, 108(42): 17432-7, 2011.

67. Tran, P.T., Bendapudi, P. K., Lin H. J., Choi, P., Koh, S., Chen, J., Horng, G., Hughes, N. P. Schwartz, L. H., Miller, V. A., Kawashima, T., Kitamura, T., Paik, D., and Felsher, D. W. Survival and death signals can predict tumor response to therapy after oncogene inactivation. Science Translational Medicine, 3(103): 103ra99, 2011.

68. Hlady, R. A., Novakova, S., Opavska, J., Klinkebiel, D., Peters, S. L., Bies, J., Hannah, J., Iqbal, J., Anderson, K. M., Siebler, H. M., Smith, L. M., Greiner, T. C., Bastola, D.,

Joshi, S., Lockridge, O., Simpson, M. A., Felsher, D. W., Wagner, K. U., Chan, W. C., Christman, J. K., and Opavsky, R. Loss of Dnmt3b function upregulates the tumor modifier Ment and accelerates mouse lymphomagenesis. Journal of Clinical Investigation, 122(1): 163-77, 2011.

69. Bachireddy, P., Rakhra, K., and Felsher, D. W. Immunology in the clinic review series: focus on cancer; multiple roles for the immune system in oncogene addiction. Clinical and Experimental Immunology, 167(2): 188-94, 2012.

70. DeChristopher, B. A., Fan, A. C., *Felsher, D. W., and Wender, P. A. "Picolog, " a synthetically-available bryostatin analog, inhibits growth of MYC-induced lymphoma in vivo. Oncotarget, vol. 3, no. 1, 2012. *co-corresponding senior author

71. Tran, P., Shroff, E., Burns, T. F., Thiyagarajan, S., Das, S. T., Zabuawala, T., Chen, J., Cho, Y., Luong, R., Tamayo, P., Salih, T., Aziz, K., Adam, S. J., Vicent, S., Nielsen, C. H., Withofs, N., Sweet-Cordero, A., Gambhir, S. S., Rudin, C. M. and Felsher, D. W. Twist1 suppresses senescence programs and thereby accelerates and maintains mutant Kras-induced lung tumorigenesis. PLoS Genetics, 8(5): e1002650, 2012.

72. Wu, A. R., Kawahara T. L., Rapicavoli, N. A., van Riggelen, J., Shroff, E. H., Xu, L., Felsher, D. W., Chang, H. Y., and Quake, S. R. High throughput automated chromatin immunoprecipitation as a platform for drug screening and antibody validation. Lab Chip, 12(12): 2190-8, 2012. Epub 2012 May 8.

73. Das, B., Bayat-Mokhtari, R., tsui, M., Lotfi, S., Tsuchida, R., Felsher, D. W., and Yeger, H. HIF-2a suppresses p53 to enhance the stemness and regenerative potential of human embryonic stem cells. Stem Cells, 30(8): 1685-1695, 2012. Doi: 10.1002/stem. 1142.

74. To, C. A., Hsieh, R. W., McClellan, J. S., Howard, W., Fischbein, N. J., Brown, J. M., Felsher, D. W., and Fan, A. C. Cryptococcal osteomyelitis and meningitis in a patient with non-hodgkin's lymphoma treated with PEP-C. BMJ Case Rep, 2012. pii:bcr0820114578. doi: 10.1136/bcr.08.2011.4578.

75. Bisikirska, B. C., Adam, S. J., Alvarez, M. J., Rajbhandari, P. Cox, R., Lefebvre, C., Wang, K., Rieckhof, G. E., *Felsher, D. W., and Califano, A. STK38 is a critical upstream regulator of MYC's oncogenic activity in human B-cell lymphoma. Oncogene, doi: 10.1038/onc.2012.543. [Epub ahead of print] *co-corresponding senior author

76. Das, B., Kashino, S. S., Pulu, I., Kalita, D., Swami, V., Yeger, H., *Felsher, D. W., and Neto-Campos, A. CD271 bone marrow mesenchymal stem cells may provide a niche for dormant mycobacterium tuberculosis. Science Translational Medicine. 5(170): 170ra13. Doi: 10.1126/scitranslmed.3004912. *corresponding senior author

77. Lin, W., Rajbhandari, N., Liu, C., Sakamoto, K., Zhang, Q., Triplett, A. A., Batra, S. K., Opavsky, R., Felsher, D. W., DiMaio, D. J., Hollingsworth, M. A., Morris 4th, J. P., Hebrok, M., Witkiewicz, A. K., Brody, J. R., Rui H., and Wagner, K. Dormant cancer cells contribute to residual disease in a model of reversible pancreatic cancer. Cancer

Research. 2013 Mar 15;73(6):1821-30. doi: 10.1158/0008-5472.CAN-12-2067. Epub 2013 Mar 6.

78. Perry, R. H., Bellovin, D. I., Shroff, E. H., Ismail, A. I., Zabuawala, T., Felsher, D. W., and Zare, R. N. Characterization of MYC-induced tumorigenesis by in situ lipid profiling. Anal Chem. 2013 May 7;85(9):4259-62. doi: 10.1021/ac400479j. Epub 2013 Apr 18.

79. Nwabugwu, C., Rakhra, K., Felsher, D. W., Paik, D. In vivo imaging-based mathematical modeling techniques that enhance the understanding of oncogene addiction in relation to tumor growth. Comput Math Methods Med. 2013;2013:802512. doi: 10.1155/2013/802512. Epub 2013.

80. Kapanadze, T., Gamrekelashvili, J., Ma, C., Chan, C., Zhao, F., Hewitt, S., Zender, L., Kapoor, V., Felsher, DW, Manns, M. P., Korangy, F., Greten T. F. Regulation of accumulation and function of myeloid derived suppressor cells in different murine models of hepatocellular carcinoma. J Hepatol. 2013 Nov;59(5):1007-13. doi: 10.1016/j.jhep.2013.06.010. Epub 2013 Jun 22.

81. Fan-Minogue H, Bodapati S, Solow-Cordero D, Fan A, Paulmurugan R, Massoud TF, Felsher DW, Gambhir SS. A c-Myc activation sensor-based high-throughput drug screening identifies an antineoplastic effect of nitazoxanide. Mol Cancer Ther. 2013 Sep;12(9):1896-905. doi: 10.1158/1535-7163.MCT-12-1243. Epub 2013 Jul 3.

82. Beurlet S, Omidvar N, Gorombei P, Krief P, Le Pogam C, Setterblad N, de la Grange P, Leboeuf C, Janin A, Noguera ME, Hervatin F, Sarda-Mantel L, Konopleva M, Andreeff M, Tu AW, Fan AC, Felsher DW, Whetton A, Pla M, West R, Fenaux P, Chomienne C, Padua RA. BCL-2 inhibition with ABT-737 prolongs survival in an NRAS/BCL-2 mouse model of AML by targeting primitive LSK and progenitor cells. Blood. 2013 Oct 17;122(16):2864-76. doi: 10.1182/blood-2012-07-445635. Epub 2013 Aug 13.

83. Ansari C, Tikhomirov GA, Hong SH, Falconer RA, Loadman PM, Gill JH, Castaneda R, Hazard FK, Tong L, Lenkov OD, Felsher DW, Rao J, Daldrup-Link HE. Development of novel tumor-targeted theranostic nanoparticles activated by membrane-type matrix metalloproteinases for combined cancer magnetic resonance imaging and therapy. Small. 2013 Aug 27. doi: 10.1002/smll.201301456. [Epub ahead of print].

84. Nwabugwu CI, Rakhra K, Felsher, DW, Paik DS. A tumor-immune mathematical model of CD4+ T helper cell dependent tumor regression by oncogene inactivation. Conf Proc IEEE Eng Med Biol Soc. 2013 Jul;2013:4529-32. doi: 10.1109/EMBC.2013.6610554.

85. Anso, E., Mullen, A. R., Felsher, DW, Mates, J. M., DeBeradinis, R. J., and Chandel, N. S. Metabolic changes in cancer cells upon suppression of MYC. Cancer & Metabolism. 2013

86. Cao, Z., Ding, B., Guo, P., Lee, S. B., Butler, J. M., Casey, S. C., Simons, M., Tam, W., Felsher, DW, Shido, K., Rafii, A., Scandura, J. M., and Rafii, S. Angiocrine factors deployed by tumor vascular niche induce b-cell lymphoma invasiveness and chemoresistance. Running title: Tumor vascular niche induces aggressive lymphoma.

Cancer Cell 2014 Mar 17;25(3):350-65. doi: 10.1016/j.ccr.2014.02.005.

87. Ye D, Shuhendler AJ, Cui L, Tong L, Tee SS, Tikhomirov G, Felsher, DW, Rao J. Bioorthogonal cyclization-mediated in situ self-assembly of small-molecule probes for imaging caspase activity in vivo. Nat Chem. 2014 Jun;6(6):519-26. doi: 10.1038/nchem.1920. Epub 2014 Apr 28.

88. Choi PS, Li Y, Felsher, DW. Addiction to multiple oncogenes can be exploited to prevent the emergence of therapeutic resistance. Proc Natl Acad Sci U S A. 2014 Aug 12;111(32):E3316-24. doi: 10.1073/pnas.1406123111. Epub 2014 Jul 28.

89. Eberlin LS, Gabay M, Fan AC, Gouw AM, Tibshirani RJ, Felsher, DW, Zare RN. Alteration of the lipid profile in lymphomas induced by MYC overexpression. Proc Natl Acad Sci U S A. 2014 Jul 22;111(29):10450-5. doi: 10.1073/pnas.1409778111. Epub 2014 Jul 3.

90. Li, Y., Choi, P., Casey, S. C., Dill, D. L., and Felsher, DW. MYC through miR-17-92 suppresses specific target genes to maintain survival, autonomous proliferation and a neoplastic state. Cancer Cell. 2014 Aug 11;26(2):262-72. doi: 10.1016/j.ccr.2014.06.014.

91. Casey, S.C, Li, Y, Fan, A.C, and Felsher, DW. Oncogene withdrawal engages the immune system to induce sustained cancer regression. J Immunother Cancer. 2014 Jul 15;2:24. doi: 10.1186/2051-1426-2-24. eCollection 2014.

92. Li Y, Choi PS, Casey SC, and Felsher DW. Activation of cre recombinase alone can induce complete tumor regression. PLOS One. 2014 Sep 10;9(9):e107589. doi: 10.1371/journal.pone.0107589. eCollection 2014.

93. Li Y, Choi PS, Felsher, DW. Oncogene addiction: resetting the safety switch? Oncotarget. 2014 Sep 30;5(18):7986-7. No abstract available. Free PMC Article

94. Li Y, Casey SC, and Felsher, DW. Inactivation of MYC reverses tumorigenesis. J Intern Med. 2014 Jul;276(1):52-60. doi: 10.1111/joim.12237.

95. Yetil A, Anchang B, Gouw AM, Adam SJ, Zabuawala T, Parameswaran R, van Riggelen J, Plevritis S, and Felsher DW. p19ARF is a critical mediator of both cellular senescence and an innate immune response associated with MYC inactivation in mouse model of acute leukemia. Oncotarget. 2015 Feb 28; 6(6):3563-77.

96. Xiang Y, Stine ZE, Xia J, Lu Y, O'Connor RS, Altman BJ, Hsieh AL, Gouw AM, Thomas AG, Gao P, Sun L, Song L, Yan B, Slusher BS, Zhuo J, Ooi LL, Lee CG, Mancuso A, McCallion AS, Le A, Milone MC, Rayport S, and Felsher, DW, Dang CV. Targeted inhibition of tumor-specific glutaminase diminishes cell-autonomous tumorigenesis. J Clin Invest. 2015 Apr 27. pii: 75836. doi: 10.1172/JCI75836. Epub 2015 Apr 27.

97. Shroff EH, Eberlin LS, Dang VM, Gouw AM, Gabay M, Adam SJ, Bellovin DI, Tran PT, Philbrick WM, Garcia-Ocana A, Casey SC, Li Y, Dang CV, Zare RN, and Felsher,

Case 23-12825-MBK Doc 2341-36 Filed 04/24/23 Entered 04/24/23 08:09:20 Desc Exhibit Exhibits A-B to Dr. Felsher Declaration Page 34 of 66

DW. MYC oncogene overexpression drives renal cell carcinoma in a mouse model through glutamine metabolism. Proc Natl Acad Sci U S A. 2015 May 26;112(21):6539-44. doi: 10.1073/pnas.1507228112. Epub 2015 May 11.

98. Altman BJ, Hsieh AL, Sengupta A, Krishnanaiah SY, Stine ZE, Walton ZE, Gouw AM, Venkataraman A, Li B, Goraksha-Hicks P, Diskin SJ, Bellovin DI, Simon MC, Rathmell JC, Lazar MA, Maris JM, Felsher, DW, Hogenesch JB, Weljie AM, Dang CV. MYC Disrupts the Circadian Clock and Metabolism in Cancer Cells. Cell Metab. 2015 Dec 1;22(6):1009-19. doi: 10.1016/j.cmet.2015.09.003. Epub 2015 Sep 17.

99. Casey SC, Tong L, Li Y, Do R, Walz S, Kelly N, Fitzergerald N, Gouw, A, Baylot V Guetegemann I, Eilers, M. Felsher DW. MYC Regulates the Anti-Tumor Immune Response through CD47 and PD-L1. Science. 2016 Mar 10. pii: aac9935. [Epub ahead of print]

100. Ma C, Kesarwala AH, Eggert T, Medina-Echeverz J, Kleiner DE, Jin P, Stroncek DF, Terabe M, Kapoor V, ElGindi M, Han M, Thornton AM, Zhang H, Egger M, Luo J, Felsher DW, McVicar DW, Weber A, Heikenwalder M, Greten TF. NAFLD causes selective CD4(+) T lymphocyte loss and promotes hepatocarcinogenesis. Nature. 2016 Mar 10;531(7593):253-7. doi: 10.1038/nature16969. Epub 2016 Mar 2.

101. Swords RT, Greenberg PL, Wei AH, Durrant S, Advani AS, Hertzberg MS, Lewis ID, Rivera G, Gratzinger D, Fan AC, Felsher DW, Cortes JE, Watts JM, Yarranton GT, Walling JM, Lancet JE. KB004, a first in class monoclonal antibody targeting the receptor tyrosine kinase EphA3, in patients with advanced hematologic malignancies: Results from a phase 1 study. Leuk Res. 2016 Nov; 50:123-131. doi: 10.1016/j.leukres.2016.09.012. PMID: 27736729.

102. Li Y, Deutzmann A, Choi PS, Fan AC, Felsher DW. BIM mediates oncogene-inactivation induced apoptosis in multiple transgenic mouse models of acute lymphoblastic leukemia. Oncotarget. 2016 May 10;7(19):26926-34. doi: 10.18632/oncotarget.8731.

103. Gouw AM, Eberlin, LS, Margulis K, Sullivan DK, Toal GG, Tong L, Zare RN, and Felsher DW. Oncogene KRAS activates fatty acid synthase, resulting in specific ERK and lipid signatures associated with lung adenocarcinoma. PNAS 2017; published ahead of print April 11, 2017, doi:10.1073/pnas.1617709114.

104. Bailey ST, Smith AM, Kardos J, Wobker SE, Wilson HL, Krishnan B, Saito R, Lee HJ, Zhang J, Eaton SC, Williams LA, Manocha U, Peters DJ, Pan X, Carroll TJ, Felsher DW, Walter V, Zhang Q, Parker JS, Yeh JJ, Moffitt RA, Leung JY, and Kim WY. MYC activation cooperates with Vhl and Ink4a/Arf loss to induce clear cell renal cell carcinoma. Nature Communications; April 2017, doi:10.1038/ncomms15770.

105. Felsher DW, Dhanasekaran R, Gabay-Ryan M, Baylot V, Lai I, Mosley A, Huang X, Zabludoff S, Li J, Kaimal V, Karmali P. Anti-miR-17 Therapy Delays Tumorigenesis in

MYC-driven Hepatocellular Carcinoma (HCC). Oncotarget, 2017-08-18 10:57:29. In press

106. Hebb J, Felsher DW, Mosley AR, Vences-Catalan F, Rajasekaran N, Rosen A, Ellmark P. Administration of low dose combination anti-CTLA4, anti-CD137, and anti-OX40 into murine tumor or proximal to the tumor draining lymph node induces systemic tumor regression. Cancer Immunology, Immunotherapy, 2018 Jan;67(1):47-60. doi: 10.1007/s00262-017-2059-y. Epub 2017 Sep 13.

107. Miess H, Dankworth B, Gouw AM, Rosenfeldt M, Schmitz W, Jiang M, Saunders B, Howell M, Downward J, Felsher DW, Peck B, Schulze A. The glutathione redox system is essential to prevent ferroptosis caused by impaired lipid metabolism in clear cell renal cell carcinoma. Oncogene. 2018 Jun 5. doi: 10.1038/s41388-018-0315-z.

108. Taparra K, Wang H, Malek R, Lafargue A, Barbhuiya MA, Wang X, Simons BW, Ballew M, Nugent K, Groves J, Williams RD, Shiraishi T, Verdone J, Yildirir G, Henry R, Zhang B, Wong J, Wang KK, Nelkin BD, Pienta KJ, Felsher D, Zachara NE, Tran PT. O-GlcNAcylation is required for mutant KRAS-induced lung tumorigenesis. J Clin Invest. 2018 Nov 1;128(11):4924-4937. doi: 10.1172/JCI94844. Epub 2018 Sep 24.

109. Lai, I, Swaminathan, S, Baylot, V, Adriane Mosley, A, Dhanasekaran, R, Ryan, M, Felsher DW. Lipid Nanoparticles that Deliver IL-12 Messenger RNA Suppress Tumorigenesis in MYC Oncogene-Driven Hepatocellular Carcinoma. Journal for Immune Therapy of Cancer, 2018 Nov 20;6(1):125. doi: 10.1186/s40425-018-0431-x.

110. Yang P, Jiang Y, Pan Y, Ding X, Rhea P, Ding J, Hawke DH, Felsher D, Narla G, Lu Z, Lee RT. Mistletoe extract Fraxini inhibits the proliferation of liver cancer by down-regulating c-Myc expression. Sci Rep. 2019 Apr 23;9(1):6428. doi: 10.1038/s41598-019-41444-2.

111. Struntz NB, Chen A, Deutzmann A, Wilson RM, Stefan E, Evans HL, Ramirez MA, Liang T, Caballero F, Wildschut MHE, Neel DV, Freeman DB, Pop MS, McConkey M, Muller S, Curtin BH, Tseng H, Frombach KR, Butty VL, Levine SS, Feau C, Elmiligy S, Hong JA, Lewis TA, Vetere A, Clemons PA, Malstrom SE, Ebert BL, Lin CY, Felsher DW, Koehler AN. Stabilization of the Max Homodimer with a Small Molecule Attenuates Myc-Driven Transcription. Cell Chem Biol. 2019 May 16;26(5):711-723.e14. doi: 10.1016/j.chembiol.2019.02.009. Epub 2019 Mar 14.

112. Das B, Pal B, Bhuyan R, Li H, Sarma A, Talukdar J, Sandhya S, Gayan S, Bhuyan S, Gogoi G, Gouw AM, Baishya D, Gotlib JR, Kataki AC, and Felsher DW. MYC regulates the HIF-2α stemness pathway via Nanog and Sox2 to maintain self-renewal in cancer stem cells versus non-stem cancer cells. Cancer Research 2019 Aug 15;79(16):4015-4025. doi: 10.1158/0008-5472.CAN-18-2847. Epub 2019 Jul 2.

113. Gouw AM, Margulis K, Liu NS, Raman SJ, Mancuso A, Toal GG, Tong L, Mosley A, Hsieh AL, Sullivan DK, Stine ZE, Altman BJ, Schulze A, Dang CV, Zare RN, and Felsher DW. The MYC oncogene cooperates with sterol regulated element-binding protein to regulate lipogenesis essential for neoplastic growth. Cell Metabolism, 2019

Aug 19. pii: S1550-4131(19)30385-7. doi: 10.1016/j.cmet.2019.07.012. [Epub ahead of print]

114. Dhanasekaran R, Baylot V, Kim M, Kuruvilla S, Bellovin D, Adeniji N, Rajan A, Lai I, Gabay M, Tong L, Krishnan M, Park J, Hu T, Barbhuiya M, Gentles A, Kannan K, Tran P, Felsher DW. MYC and Twist1 cooperate to drive metastasis by eliciting crosstalk between cancer and innate immunity. eLife Sciences, 2020 Jan 14;9. pii: e50731. doi: 10.7554/eLife.50731.

115. Smith MT, Guyton KZ, Kleinstreuer N, Borrel A, Cardenas A, Chiu WA, Felsher DW, Gibbons CF, Goodson WH, Houck KA, Kane A, La Merrill MA, Lebrec H, Lowe L, McHale CM, Minocherhomji S, Rieswijk L, Sandy MS, Sone H, Wang A, Zhang L, Zeise L, Fielden M. The key characteristics of carcinogens: Relationship to the hallmarks of cancer, relevant biomarkers, and assays to measure them. Cancer Epidemiology Biomarkers Prevention. 2020 Mar 9. pii: cebp.1346.2019. doi: 10.1158/1055-9965.EPI-19-1346. [Epub ahead of print]

116. Dhanasekaran R, Park J, Yevtodiyenko A, Bellovin DI, Adams SJ, Rajan AKD, Gabay M, Fernando H, Arzeno J, Arjunan V, Gryanzov S, Felsher DW. MYC ASO impedes tumorigenesis and elicits oncogene addiction in autochthonous transgenic mouse models of HCC and RCC. Molecular Therapy Nucleic Acids. 2020 Sep 4; 21: 850–859. Published online 2020 Jul 10 doi: 10.1016/j.omtn.2020.07.08

117. Mahauad-Fernandez WD, Felsher DW. The Myc and Ras partnership in cancer: Indistinguishable alliance or contextual relationship? Cancer Research | Perspective 2020, doi: 10.1158/0008-5472.CAN-20-0787. Published September 2020.

118. Cui L, Gouw AM, LaGory EL, Guo S, Attarwala N, Tang Y, Qi J, Chen YS, Gao Z, Casey KM, Bazhin AA, Chen M, Hu L, Xie J, Fang M, Zhang C, Zhu Q, Wang Z, Giaccia AJ, Gambhir SS, Zhu W, Felsher DW, Pegram MD, Goun EA, Le A, Rao J. Mitochondrial copper depletion suppresses triple-negative breast cancer in mice. Nat Biotechnol. 2020 Oct 19. doi: 10.1038/s41587-020-0707-9. Online ahead of print.

119. Krishnan MS, Rajan Kd A, Park J, Arjunan V, Garcia Marques FJ, Bermudez A, Girvan OA, Hoang NS, Yin J, Nguyen MH, Kothary N, Pitteri S, Felsher DW, Dhanasekaran R. Genomic analysis of vascular invasion in hepatocellular carcinoma (HCC) reveals molecular drivers and predictive biomarkers. Hepatology. 2020 Nov 3. doi: 10.1002/hep.31614. Online ahead of print.

120. Hori SS, Tong L, Swaminathan S, Liebersbach M, Wang J, Gambhir SS, Felsher DW. A mathematical model of tumor regression and recurrence after therapeutic oncogene inactivation. Science Reports. 2021; 11: 1341. Published online 2021 Jan 14. doi: 10.1038/s41598-020-78947-2.

121. Eguiarte-Solomon F, Blazanin N, Rho O, Carbajal S, Felsher DW, Tran PT, DiGiovanni J. Twist1 is required for development of UVB-Induced squamous cell carcinoma. Molecular Carcinogenesis. Published online 13 March 2021. doi: 10.1002/mc.23296.

122. Dhanasekaran R, Deutzmann A, Mahauad-Fernandez WD, Hansen AS, Gouw, Felsher DW. The MYC oncogene — the grand orchestrator of cancer growth and immune evasion. Nature Reviews Clinical Oncology (2021) Published 10 September 2021. doi.org/10.1038/s41571-021-00549-2.

123. Lee CK, Atibalentja DF, Yao LE, Park J, Kuruvilla S, Felsher DW. Anti-PD-L1 F(ab) conjugated PEG-PLGA nanoparticle enhances immune checkpoint therapy. Nanotheranostics 2022; 6(3):243-255. doi:10.7150/ntno.65544.

124. Gouw A, Kumar V, Resendez A, Alvina F, Liu N, Margulis K, Tong L, Zare R, Malhotra S, and Felsher D. Azapodophyllotoxin Causes Lymphoma and Kidney Cancer Regression by Disrupting Tubulin and Monoglycerols. ACS Medicinal Chemistry Letters, ml-2021-00673x.R1, *in press.*

<u>Non-Peer-Reviewed articles</u> (total of 2)

1. Braun, J., Ando, D., Denis, K., Felsher, DW., Govan, H., and Krall, W. Generation and characterization of murine Ly-1 (CD5) B-cell lines. In: O. N. Witte, N. Klinman, M. C. Howard (Eds), B- cell development: UCLA symposia in Molecular and Cellular Biology, New Series, pp. 55-67, New York: Alan R. Liss, Inc., 1988.

2. Braun, J., Felsher, D. W., and Goodglick, L. A. C-MYC, MHCI, and NK resistance in immunodeficiency lymphomas. Annals NY Academy of Sciences, 651:467, 1992.

<u>Reviews (total of 34)</u>

1. Felsher, DW. Cancer Revoked: Oncogenes as therapeutic targets. Nature Reviews Cancer, 3(5) 375, 2003.

2. Giuriato, S., Felsher, DW. How cancers escape their oncogene habit. Cell Cycle, 2(4): 329, 2003.

3. Felsher, DW., and Bradon, N. Pharmacological inactivation of MYC for the treatment of cancer. Drug News Perspect, 16(6): 370-4 2003.

4. Felsher, DW. Oncogenes as therapeutic targets. Seminars in Cancer Biology, (1): 1, 2004.

5. Giuriato, S., Rabin, K, Fan, A. C., Shachaf, C. M., and Felsher, DW. Conditional animal models: a strategy to define when oncogenes will be effective targets to treat cancer. Seminars in Cancer Biology, 14(1): 3-11, 2004.

6. Felsher, DW. Reversibility of oncogene induced cancer. Current Opinion Genetics and Development, 14(1): 37-42, 2004.

7. Felsher, DW. Putting oncogenes into a developmental context. Cancer Biology & Therapy, 3(10): 942-4 EPUB 2004.

8. Shachaf, C. M., and Felsher, DW. Tumor dormancy and MYC inactivation: Pushing cancer to the brink of normalcy. Cancer Research, 65:(11) 4471-4, 2005.

9. Shachaf, C. M., and Felsher, DW. Rehabilitation of cancer through oncogene inactivation. Trends in Molecular Medicine, 11(7): 316-21, 2005.

10. Bachireddy, P. Bendapudi, P., and Felsher, DW. Getting at MYC through RAS. Clinical Cancer Research, 11(12): 4278-81, 2005.

11. Arvanitis, C., and Felsher, DW. Conditionally MYC: insights from novel transgenic models. Elsevier, Cancer Letters, 226(2): 95-9, 2005.

12. Felsher, DW. Tumor Dormancy-Death and resurrection of cancer as seen through transgenic mouse models. Cell Cycle, 5(16): 1808-11, 2006.

13. Arvanitis, C., and Felsher, DW. Conditional transgenic models define how MYC initiates and maintains tumorigenesis. Seminars in Cancer Biology, 16(4): 313-7, 2006.

14. Felsher, DW. Oncogene addiction versus oncogene amnesia: Perhaps more than just a bad habit? Cancer Research, 68(9): 3081-6, 2008.

15. Felsher, DW. Tumor dormancy and oncogene addiction. Acta Pathologica, Microbiologica et Immunologica Scandinavica, 116(7-8): 629-37, 2008.

16. van Riggelen, J. and Felsher, DW. Myc and a Cdk2 senescence switch. Nature Cell Biology, 12(1): 7-9, 2010.

17. van Riggelen, J., Yetil, A., and Felsher, DW. MYC as a regulator of ribosome biogenesis and protein synthesis. Nature Reviews Cancer, 10(4): 301-9, 2010.

18. Felsher, D. W. MYC inactivation elicits oncogene addiction through both tumor cell-intrinsic and host-dependent mechanisms. Genes Cancer, 1(6): 597-604, 2010.

19. Bellovin, D.I., Das, B., Felsher, DW. Tumor dormancy, oncogene addiction, cellular senescence, and self-renewal programs. Adv Exp Med Biol. 2013;734:91-107. doi: 10.1007/978-1-4614-1445-2_6.

20. Felsher, D. W. Role of mycn in retinoblastoma. Lancet Oncol. 2013 Apr;14(4):270-1. doi: 10.1016/S1470-2045(13)70070-6. Epub 2013 Mar 13.

21. Casey, S. C., Bellovin, D. I., and Felsher, DW. Noncanonical roles of the immune system in eliciting oncogene addiction. Current Opinion Immunology, 2013 doi:pii: S0952-7915(13)00023-X. 10.1016/j.coi.2013.02.003 [Epub ahead of print].

22. Fan, A.C., O'Rourke, J.J., Praharaj, D.R., Felsher DW. Real-time nanoscale proteomic analysis of the novel multi-kinase pathway inhibitor rigosertib to measure the response to treatment of cancer. Expert Opin Investig Drugs. 2013 Nov;22(11):1495-509. doi: 10.1517/13543784.2013.829453. Epub 2013 Aug 12.

23. Rakhra, K., Felsher, DW. Generation of a tetracycline regulated mouse model of MYC-induced T-cell acute lymphoblastic leukemia. Methods Mol Biol. 2013;1012:221-35. doi: 10.1007/978-1-62703-429-6_15.
24. Casey, C. C., Li, Y., Felsher, DW. An essential role for the immune system in the mechanism of tumor regression following targeted oncogene inactivation. Immunologic Research, May 2014 58(2-3):282-91. doi: 10.1007/s12026-014-8503-6.

25. Casey SC, Amedei A, Aquilano K, Azmi AS, Benencia F, Bhakta D, Bilsland AE, Boosani CS, Chen S, Ciriolo MR, Crawford S, Fujii H, Georgakilas AG, Guha G, Halicka D, Helferich WG, Heneberg P, Honoki K, Keith WN, Kerkar SP, Mohammed SI, Niccolai E, Nowsheen S, Vasantha Rupasinghe HP, Samadi A, Singh N, Talib WH, Venkateswaran V, Whelan RL, Yang X, Felsher DW. Cancer prevention and therapy through the modulation of the tumor microenvironment. Semin Cancer Biol. 2015 Dec;35 Suppl:S199-223. doi: 10.1016/j.semcancer.2015.02.007. Epub 2015 Apr 10. Review.

26. Casey SC, Vaccari M, Al-Mulla F, Al-Temaimi R, Amedei A, Barcellos-Hoff MH, Brown DG, Chapellier M, Christopher J, Curran CS, Forte S, Hamid RA, Heneberg P, Koch DC, Krishnakumar PK, Laconi E, Maguer-Satta V, Marongiu F, Memeo L, Mondello C, Raju J, Roman J, Roy R, Ryan EP, Ryeom S, Salem HK, Scovassi AI, Singh N, Soucek L, Vermeulen L, Whitfield JR, Woodrick J, Colacci A, Bisson WH, Felsher DW. The effect of environmental chemicals on the tumor microenvironment. Carcinogenesis. 2015 Jun;36 Suppl 1:S160-83. doi: 10.1093/carcin/bgv035. Review.

27. Goodson WH 3rd, Lowe L, Carpenter DO, Gilbertson M, Manaf Ali A, Lopez de Cerain Salsamendi A, Lasfar A, Carnero A, Azqueta A, Amedei A, Charles AK, Collins AR, Ward A, Salzberg AC, Colacci A, Olsen AK, Berg A, Barclay BJ, Zhou BP, Blanco-Aparicio C, Baglole CJ, Dong C, Mondello C, Hsu CW, Naus CC, Yedjou C, Curran CS, Laird DW, Koch DC, Carlin DJ, Felsher DW, Roy D, Brown DG, Ratovitski E, Ryan EP, Corsini E, Rojas E, Moon EY, Laconi E, Marongiu F, Al-Mulla F, Chiaradonna F, Darroudi F, Martin FL, Van Schooten FJ, Goldberg GS, Wagemaker G, Nangami GN, Calaf GM, Williams G, Wolf GT, Koppen G, Brunborg G, Lyerly HK, Krishnan H, Ab Hamid H, Yasaei H, Sone H, Kondoh H, Salem HK, Hsu HY, Park HH, Koturbash I, Miousse IR, Scovassi AI, Klaunig JE, Vondráček J, Raju J, Roman J, Wise JP Sr, Whitfield JR, Woodrick J, Christopher JA, Ochieng J, Martinez-Leal JF, Weisz J, Kravchenko J, Sun J, Prudhomme KR, Narayanan KB, Cohen-Solal KA, Moorwood K, Gonzalez L, Soucek L, Jian L, D'Abronzo LS, Lin LT, Li L, Gulliver L, McCawley LJ, Memeo L, Vermeulen L, Leyns L, Zhang L, Valverde M, Khatami M, Romano MF, Chapellier M, Williams MA, Wade M, Manjili MH, Lleonart ME, Xia M, Gonzalez MJ, Karamouzis MV, Kirsch-Volders M, Vaccari M, Kuemmerle NB, Singh N, Cruickshanks N, Kleinstreuer N, van Larebeke N, Ahmed N, Ogunkua O, Krishnakumar PK, Vadgama P, Marignani PA, Ghosh PM, Ostrosky-Wegman P, Thompson PA, Dent P, Heneberg P, Darbre P, Sing Leung P, Nangia-Makker P, Cheng QS, Robey RB, Al-Temaimi R, Roy R, Andrade-Vieira R, Sinha RK, Mehta R, Vento R, Di Fiore R, Ponce-Cusi R, Dornetshuber-Fleiss R, Nahta R, Castellino RC, Palorini R, Abd Hamid R, Langie SA, Eltom SE, Brooks SA, Ryeom S, Wise SS, Bay SN, Harris SA, Papagerakis S, Romano S, Pavanello S, Eriksson S, Forte S, Casey SC, Luanpitpong S, Lee TJ, Otsuki T, Chen T, Massfelder T, Sanderson T, Guarnieri T, Hultman T, Dormoy V, Odero-Marah V,

Sabbisetti V, Maguer-Satta V, Rathmell WK, Engström W, Decker WK, Bisson WH, Rojanasakul Y, Luqmani Y, Chen Z, Hu Z. Assessing the carcinogenic potential of low-dose exposures to chemical mixtures in the environment: the challenge ahead. Carcinogenesis. 2015 Jun;36 Suppl 1:S254-96. doi: 10.1093/carcin/bgv039. Review.

28. Kearney AY, Anchang B, Plevritis S, Felsher DW. ARF: connecting senescence and innate immunity for clearance. Aging (Albany NY). 2015 Sep;7(9):613-5.

29. Block KI, Gyllenhaal C, Lowe L, Amedei A, Amin AR, Amin A, Aquilano K, Arbiser J, Arreola A, Arzumanyan A, Ashraf SS, Azmi AS, Benencia F, Bhakta D, Bilsland A, Bishayee A, Blain SW, Block PB, Boosani CS, Carey TE, Carnero A, Carotenuto M, Casey SC, Chakrabarti M, Chaturvedi R, Chen GZ, Chen H, Chen S, Chen YC, Choi BK, Ciriolo MR, Coley HM, Collins AR, Connell M, Crawford S, Curran CS, Dabrosin C, Damia G, Dasgupta S, DeBerardinis RJ, Decker WK, Dhawan P, Diehl AM, Dong JT, Dou QP, Drew JE, Elkord E, El-Rayes B, Feitelson MA, Felsher DW, Ferguson LR, Fimognari C, Firestone GL, Frezza C, Fujii H, Fuster MM, Generali D, Georgakilas AG, Gieseler F, Gilbertson M, Green MF, Grue B, Guha G, Halicka D, Helferich WG, Heneberg P, Hentosh P, Hirschey MD, Hofseth LJ, Holcombe RF, Honoki K, Hsu HY, Huang GS, Jensen LD, Jiang WG, Jones LW, Karpowicz PA, Keith WN, Kerkar SP, Khan GN, Khatami M, Ko YH, Kucuk O, Kulathinal RJ, Kumar NB, Kwon BS, Le A, Lea MA, Lee HY, Lichtor T, Lin LT, Locasale JW, Lokeshwar BL, Longo VD, Lyssiotis CA, MacKenzie KL, Malhotra M, Marino M, Martinez-Chantar ML, Matheu A, Maxwell C, McDonnell E, Meeker AK, Mehrmohamadi M, Mehta K, Michelotti GA, Mohammad RM, Mohammed SI, Morre DJ, Muralidhar V, Muqbil I, Murphy MP, Nagaraju GP, Nahta R, Niccolai E, Nowsheen S, Panis C, Pantano F, Parslow VR, Pawelec G, Pedersen PL, Poore B, Poudyal D, Prakash S, Prince M, Raffaghello L, Rathmell JC, Rathmell WK, Ray SK, Reichrath J, Rezazadeh S, Ribatti D, Ricciardiello L, Robey RB, Rodier F, Rupasinghe HP, Russo GL, Ryan EP, Samadi AK, Sanchez-Garcia I, Sanders AJ, Santini D, Sarkar M, Sasada T, Saxena NK, Shackelford RE, Shantha Kumara HM, Sharma D, Shin DM, Sidransky D, Siegelin MD, Signori E, Singh N, Sivanand S, Sliva D, Smythe C, Spagnuolo C, Stafforini DM, Stagg J, Subbarayan PR, Sundin T, Talib WH, Thompson SK, Tran PT, Ungefroren H, Vander Heiden MG, Venkateswaran V, Vinay DS, Vlachostergios PJ, Wang Z, Wellen KE, Whelan RL, Yang ES, Yang H, Yang X, Yaswen P, Yedjou C, Yin X, Zhu J, Zollo M. Designing a broad-spectrum integrative approach for cancer prevention and treatment. Semin Cancer Biol. 2015 Dec;35 Suppl:S276-304. doi: 10.1016/j.semcancer.2015.09.007. Review.

30. Gouw AM, Toal GG, Felsher DW. Metabolic vulnerabilities of MYC-induced cancer. Oncotarget. 2016 Feb 6. doi: 10.18632/oncotarget.7223. [Epub ahead of print] Review.

31. Li Y, Deutzmann A, Felsher DW.BIM-mediated apoptosis and oncogene addiction. Aging (Albany NY). 2016 Sep 29;8(9):1834-1835. doi: 10.18632/aging.101072. No abstract available. PMID: 27688082 Free PMC Article

32. Felsher DW, Lowe L. Affordable Cancer Medications are within reach but we need a different approach. J Clin Oncol. 2016 Jun 20;34(18):2194-5. doi: 10.1200/JCO.2016.67.2436. No abstract available. PMID: 27161965

33. Casey SC, Baylot V, Felsher DW. The MYC oncogene is a global regulator of the immune response. Blood. 2018 May 3;131(18):2007-2015. doi: 10.1182/blood-2017-11-742577. Epub 2018 Mar 7. Review. PMID: 29514782

34. Felsher DW. A Tale of Two Complications of Obesity: Nonalcoholic steatohepatitis (NASH) and hepatocellular carcinoma (HCC). Hepatology, 2019 Apr 8. doi: 10.1002/hep.30649. [Epub ahead of print] No abstract available. PMID: 30958566

Abstracts: (total of 59)

1. Felsher, D. W., Dennis, K. A., Weiss, D., Ando, D. T., and Braun, J. A murine model of CD5+ B-cell lymphomagenesis in immune compromised hosts. UCLA Symposia: B-cell Development, 1988.

2. Felsher, D. W., Ando, D. T., and Braun, J. Independent rearrangement of lambda light chain in CD5+ B-cells. Western Conference Immunology. Asilomar, CA, 1988.

3. Felsher, D. W., Ando, D. T., and Braun. J. Independent rearrangement of lambda light chain in CD5+ B-cells. Western Conference of Molecular Biology. Berkeley, CA, 1989.

4. Felsher, D. W., and Braun, J. Pathophysiology of CD5+ B-cells. UCLA Symposia: B-cell development. Taos, NM, 1990.

5. Felsher, D. W., and Braun, J. A murine model of CD5+ B-cell lymphomagenesis. Western Conference of Immunology. Asilomar, CA, 1990.

6. Goodglick, L. A., Felsher, D. W., Anderson, M., Hassett, T., and Braun, J. B-cell specific binding to VH11 leader sequence. FASEB. Atlanta, GA, 1991.

7. Felsher, D. W. Defining when inactivation of the MYC oncogene is sufficient to results in sustained regression of lymphoma. FOCIS, June 1992.

8. Felsher, D. W., and Bishop, J.M. Hematopoietic tumorigenesis by MYC using a conditional transgenic model system. ASH, December 1999.

9. Felsher, D. W., and Tang, F. Song, SS., Beer, S. MYC inactivation in hematopoietic tumors that have lost p53 still regress, but subsequently relapse. ASH, San Francisco CA, December 2000.

10. Felsher, D. W., and Zetterberg, A., Zhu, JY., Tlsty T., Bishop, J. M. Over-expression of MYC causes p53-dependent G2 arrest of normal fibroblasts. ASCB, San Francisco CA, December 2000.

11. Felsher, D. W., and Tang, F., Sundberg, C., Karlsson, A., Giuriato, S. Defining when MYC-induced lymphomagenesis is reversible. ASH, Orlando, FL, December 2001.

12. Karlsson, A., Fung-Weier, J., Pedersen, R., and Felsher, D. W. Genetically complex hematopoietic tumors undergo sustained regression upon MYC inactivation. SALK/EMBL, San Diego, CA, August 2001.

13. Jain, M., Arvanitis, C., Chu, K., Dewey, W., Leonhardt, E., Trinh, M., and Felsher, D. W. Brief cessation of MYC over-expression results in the abrogation of a neoplastic phenotype. SALK/EMBL, San Diego, CA, August 2001.

14. Sundberg, C. D., Tang, F., and Felsher, D. W. The loss of p53 function prevents MYC inactivation from causing sustained tumor regression. SALK/EMBL, San Diego, CA, August 2001.
15. Felsher, D. W., Arvanitis, C., Beer, S., Deb-Basu, D., Feng, C., Giuriato, S., Karlsson, A., Shachaf, C., Sundberg, C., Tang, F., and Yang, Q. Defining when MYC-induced tumorigenesis is reversible. SALK/EMBL, San Diego, CA, August 2001.

16. Deb-Basu, D., Karlsson, A., and Felsher D. W. Restoration of p27 function prevents MYC from inducing genomic instability and apoptosis. AACR, San Francisco, CA, April 2002.

17. Arvanitis, C., Jain, M., Chu, K., Dewey, W., Leonhardt, E., Trinh, M., and Felsher, D. W. Brief loss of MYC over-expression results in the suppression of a neoplastic phenotype. AACR, San Francisco, CA, April 2002.

18. Tang, F., Sundberg, C. D., Giuriato, S., and Felsher, D. W. The loss of p53 function prevents MYC inactivation from causing sustained tumor regression. AACR, San Francisco, CA, April 2002.

19. Giuriato, S., Tang, F., Drago, K., Sundberg, C. D., and Felsher, D. W. Cooperation between MYC and RAS in the induction and maintenance of hematopoietic tumorigenesis. AACR, San Francisco, CA, April 2002.

20. Karlsson, A., Fung-Weier, J., Pedersen, R., and Felsher, D. W. Genetically complex hematopoietic tumors undergo sustained regression upon MYC inactivation. AACR, San Francisco, CA, April 2002.

21. Felsher, D. W. Defining when inactivation of the MYC oncogene is sufficient to result in sustained regression of lymphoma. FOCIS, San Francisco, CA, June 2002.

22. Shachaf, C. and Felsher, D. W. Threshold levels of MYC expression required to maintain a neoplastic phenotype is modulated by cell cycle regulatory genes. FOCIS, San Francisco, CA, June 2002.

23. Deb-Basu, D., Karlsson, A., and Felsher, D. W. Restoration of p27 function MYC from inducing genomic instability and apoptosis. SALK, San Diego, CA, June 2002.

24. Shachaf, C. and Felsher, D. W. Targeting MYC inactivation for the treatment of lymphoma. SALK, San Diego, CA, June 2002.

25. Felsher, D. W. Deb-Basu, D., and Karlsson, A., Restoration of p27 function prevents MYC from inducing genomic instability and apoptosis. ASCB, San Francisco, CA, December 2002.

26. Giuriato, S., Passegue, E., Fan, A., Tang, F., and Felsher, D. W. Defining the genetic contexts when MYC inactivation induces sustained regression of hematopoietic tumors. ASH, San Diego, CA, December 2003.

27. Rabin, K., Giuriato, S., Ray, S., and Felsher, D. W. MYC inactivation induces tumor regression through the recovery of a functional DNA damage response. ASH, San Diego, CA, December 4-7, 2004.

28. Fan, A.C., Giuriato, S., Feng, C., Padua, R. A., and Felsher, D. W. Cooperation between MYC and BCL2 to induce lymphoma is uncovered in an adult context. ASH, San Diego, CA, December 4-7, 2004.

29. Shachaf, C.M., Bendapudi, P.K., Bradon, N., Yang, Q., Borowsky, A.D., Ruebner, B., and Felsher, D.W. Characterization of tumor dormancy and the liver cancer stem cell uncovered upon myc inactivation in hepatocellular cancer. AACR, Maui Hi, March 22-26, 2005.

30. Fan, A.C., Giuriato, S., Karlsson, A., Padua, R.A., Felsher, D.W. Two oncogenic hits are required to initiate lymphomagenesis in adult, but not neonatal hosts. ASH, Atlanta, GA, December 10-13, 2005.

31. Fan, A.C., Giuriato, S., Karlsson, A., Bachireddy, P., Bendapudi, P., Rakhra, K., Padua, R.A., Felsher. D.W. MYC or RAS, but not BCL2 expression induces reversible lymphomagenesis. AACR, Washington DC, April 1-5, 2006.

32. Fan, A.C., Voehringer, D., Deb-Basu, D., Gossett, J., O'Neill, O., Felsher, D.W. Nanoliter-scale western-blot-like BCL-2 analysis of lymphoma fine needle aspirates. AACR, Washington DC, April 1-5, 2006.

33. Fan, A.C., Voehringer, D., Deb-Basu, D., Gossett, J., O'Neill, R., Felsher, D.W. MYC quantification in lymphoma fine needle aspirates using, firefly, a novel nanofluidic protein analysis instrument. AACR, Washington DC, April 1-5, 2006.

34. Bachireddy, P., Fan, A., Rakhra, K., Zeiser, R., Kopelman, A., Negrin, R. S., Contag, C.H., Felsher, D.W. The effects of host immune status on the consequences of oncogene inactivation. AACR, Cambridge Massachusetts, October 25, 2006.

35. Riggelen, J. v., Wu, N., Felsher, D. W. The impact of epigenetics on tumor regression upon MYC oncogene inactivation. AACR, Cambridge Massachusetts, October 25, 2006.

36. Fan, A. C., Deb-Basu, D., Horoschak, M., Shirer, A., Voehringer, D., O'Neill, R., Felsher, D. W. Nano-fluidic detection of oncoprotein signaling in preclinical and patient lymphoma samples. ASH, Orlando, Florida, December 10, 2006.

37. Deb-Basu, D., Fan, A., Voehringer, D., Ferrante, J., Bhamidipatil, A., Gossett, J., O'Neill, R., Felsher, D.W. Measurement of oncoproteins in preclinical and clinical specimens using a non-fluidic high throughput approach. ASCB, San Diego, CA, December13, 2006.

38. Wu, N., Riggelen, J.v., Yetil, A., Felsher, D. W. Cellular senescence programs are an important mechanism of tumor regression. AACR, Los Angeles, CA, April 14-18, 2007.

39. Deb-Basu, D., Fan, A. C., Voehringer, D., Felsher, D. W. Monitoring drug impact on signaling pathways in precious samples in primary hematopoietic malignancies. AACR, Los Angeles, CA, April 14-18, 2007.

40. Choi, P. S., Rabin, K., Giuriato, S., Ray, S., Yang, Q., Felsher, D. W. Loss of ATM or H2AX accelerates MYC-induced tumorigenesis and prevents sustained tumor regression. AACR, Los Angeles, CA, April 14-18, 2007.

41. Fan, A., Deb-Basu, D., Gotlib, J., Voehringer, D., Felsher, D. W. Monitoring changes in signaling proteins upon oncogene inactivation in hematopoietic tumors using a nano-immunoassay system. AACR, San Diego, CA, April 12-16, 2008.

42. Deb-Basu, D., Fan, A., Voehringer, D., Felsher, D. W. Measurement of oncoproteins in primary hematopoietic malignancies pre-and post therapy using a nano-immunoassay system. AACR, San Diego, CA, April 12-16, 2008.

43. Shachaf, C. M., Gentles, A., Elchuri, S., Sahoo, D., Chang, M., Sharpe, O., Nolan, G., Plevritis, S., Felsher, D. W. Genomic and proteomic analysis reveals a threshold level of MYC required for tumor maintenance. AACR, San Diego, CA, April 12-16, 2008.

44. Riggelen, J. V., Felsher, D. W. The epigenetic context determines myc's oncogenic potential in a conditional mouse model for osteosarcoma. AACR, San Diego, CA, April 12-16, 2008.

45. Wu, C. H., Sahoo, D., Arvanitis, C., Bradon, N., Felsher, D. W. Comparative analysis of murine and human microarrys reveals a gene signature associated with the ability of myc to maintain tumorigenesis. AACR, San Diego, CA, April 12-16, 2008.

46. Horng, G. S., Tran, P. T., Chen, J., Bendapudi, P. K., Lin J., and Felsher, D. W. S-transfarnesylthiosalicylic acid (FTS) inhibits growth of k-ras4bG12D and myc induced primary lung adenocarcinoma in conditional mouse models of malignancy. American Thoracic Society International Conference, Toronto, Ontario, Canada, May 16-21, 2008.

47. Lin, H. J., Tran, P. T., Bendapudi, P. K., Chen, J., Horng, G., Felsher, D. W., Paik, D. S. A predictive model of oncogene-addiction. World Molecular Imaging Congress, September 2008.

48. Lin, H. J., Tran, P. T., Bendapudi, P. K., Chen, J., Horng, G., Felsher, D. W., Paik, D. S. A mathematical model of the escape mechanism that differentiates the behavior of oncogene- and non-oncogene addicted tumor cells. World Molecular Imaging Congress, September 2008.

49. Fan, A. C., Deb-Basu, D., Gotlib, J. R., Orban, M. P., Voehringer, D., Felsher, D. W. Quantification of changes in protein phosphorylation during targeted therapy of primary hematopoietic malignancies using a nano-immunoassay system. ASCO-NCI-EORTC Annual Meeting on Molecular Markers in Cancer, Hollywood, Florida, October 30-November 1, 2008.

50. Fan, A. C., Orban, M. W., Shirer, A. E., Rajwanshi, R., Kong, C., Natkunam, Y., Lee, H. E., Coutre, S., Felsher, D. W. Nanoscale analysis of changes in signaling proteins in patients

treated with single agent atorvastatin for low grade or refractory NHL. American Society of Clinical Oncology 2009 Annual Meeting, Orlando, Florida, May 29-June 2, 2009.

51. McClellan, S., To, C., Sikic, B. I., Brown, J. M., Fan, A., Felsher, D. W. Rib lesion in an oncology patient: Cancer or an uncommon presentation of an infectious disease? ACP Northern Chapter Conference.

52. Fan, A. C., Dermody, J., Kong, C., Zhang, N., Colevas, A. D., and Felsher, D. W. Nanoimmunoassay profiling of ERK and MEK isoforms in fine needle aspirates of solid tumors. ASCO Annual 2010 Meeting, Chicago, Illinois, June 4-6, 2010.

53. Fan, A. C., Dermody, J. L., Kong, C., Zhang, N., Xu, L., Renschler, J. P., Orban, M. W., Varasteh, B., Sridhar, K., Natkunam, Y., Coutre, S. E., Greenberg, P. and Felsher, D. W. Nanoscale approaches to define biologic signatures and measure proteomic response to targeted therapies in hematologic and solid tumors. AACR Fourth International Conference on Molecular Diagnostics in Cancer Therapeutic Development: Challenges and New Horizons. Denver CO, September 27-30, 2010.

54. Fan, A. C., Xu, L., Sridhar, K., Tran, M., Banerjee, P., Renschler, J. P., Tripuraneni, R., Wilhelm, F., Greenberg, P., and Felsher, D. W. A Novel Nano-immunoassay (NIA) Reveals Inhibition of PI3K and MAPK Pathways in CD34+ Bone Marrow Cells of Patients with Myelodysplastic Syndrome (MDS) Treated with the Multi-Kinase Inhibitor ON 01910.Na (Rigosertib). 53rd ASH Annual Meeting and Exposition, San Diego, CA, December 10-13, 2011.

55. Fan, A., Banerjee, P. and Felsher, D. W. A novel automated microfluidic size-based proteomic assay rapidly generates quantitative profiles of MAPK and PI3K proteins in clinical specimens. AACR Annual Meeting 2012, Chicago, Ill, March 31-April 4, 2012.

56. Ismail, A., Perry, R., Shroff, E., Zabuawala, T., Bellovin, D., Felsher, D. W., Zare, R. Desorption Electrospray Ionization Imaging Mass Spectrometry Identifies Lipid Species Regulated by the c-MYC Oncogene. ASMS Conference. Vancouver, BC, May 19-20, 2012.

57. Fan, A. C., Banerjee, P., Leppert, J., Harshman, L. C., Sabatti, C., Brooks, J. D., and Felsher, D. W. Nano-immuno assay generates rapid, quantitative nano-scale proteomic profiling of the hypoxia pathway in renal cell carcinoma clinical specimens. ASCO 2012 Annual Meeting, Chicago, Ill, June 1-5, 2012.

58. Nwabugwu, C., Felsher, D. W., and Paik, D. Mathematical modeling of the sequence of and interactions between cellular programs in response to oncogene inactivation measured by bioluminescence imaging. 2012 World Molecular Imaging Congress, Dublin Ireland, September 5-8, 2012.

59. Eberlin, L. S., Shroff, E. H., Zhang, J., Bellovin, D. I., Tibshirani, R., Felsher, D. W., and Zare, R. N. DESI-MS imaging of lipids and metabolites in cancers activated by the MYC and RAS oncogenes. ASMS 2013 Annual Conference, Minneapolis, MN, June 9-13, 2013.

Invited Presentations: (total of 277)

1. Felsher, D. W. Ando, D. T., and Braun, J., Independent Rearrangement of Lambda Light Chain in CD5+ B-cells. Western Conference of Molecular Biology, Berkeley, CA, 1989.

2. Felsher, D. W. and Braun, J. Pathophysiology of CD5+ B-cells. UCLA Symposia: B-cell Development. Taos, NM, 1990.

3. Felsher, D. W. and Braun, J. A Murine Model of CD5+ B-cell Lymphomagenesis. Western Conference of Immunology. Asilomar, CA, 1990.

4. Felsher, D. W. and Braun, J. A Murine Model for the Pathophysiology of CD5+ B-cells. Annual MSTP Conference, Aspen, CO, 1990.

5. Felsher, D. W. and Braun, J. CD5+ B-cells. Western Conference of Pathology. Los Angeles, CA, 1991.

6. Felsher, D. W. MYC Induces Genomic Destabilization. Stanford-UCSF Grand Rounds, San Francisco, CA, 1996.

7. Felsher, D. W. Transient MYC Overexpression Induces Tumorigenesis and Genomic Destabilization. UCSF, Mission Center, San Francisco, CA, 1998.

8. Felsher, D. W. The Mechanism of MYC Induced Tumorigenesis. UCSF, Division of Hematology-Oncology Grand Rounds, San Francisco, CA, 1998.

9. Felsher, D. W. Is MYC Induced Tumorigenesis Reversible? Grand Rounds, Gladstone Institute, San Francisco General Hospital, San Francisco, CA, 1998.

10. Felsher, D. W. MYC Induced Tumorigenesis, Invited Speaker. HHMI Physician Scientist Meeting, 1998.

11. Felsher, D. W. MYC Induced Genomic Destabilization and Tumorigenesis. UCSF Cancer Center, Hematopoietic Malignancies Group, San Francisco, CA, 1998.

12. Felsher, D. W. New Insights Into the Mechanism of MYC Induced Tumorigenesis. UCSF Cancer Center Discussion Group, San Francisco, CA, 1998.

13. Felsher, D. W. Oncogenes as Targets for the Therapy of Lymphoma. Lymphoma Research Foundation Conference, 1998.

14. Felsher, D. W. Reversible Tumorigenesis by MYC, Microbiology Seminar Series. UCSF, San Francisco, CA, May 1999.

15. Felsher, D. W. Reversible Tumorigenesis by MYC Using a Conditional Transgenic Model. Invited speaker, Oncogenes and Growth Control Meeting, Salk Institute, August 1999.

16. Felsher, D. W. Reversible Tumorigenesis by MYC Using a Conditional Transgenic Model. Invited speaker, Hematology Seminar, Stanford University, Stanford, CA, October 1999.

17. Felsher, D. W. Reversible Tumorigenesis by the MYC Proto-Oncogene Using a Conditional Transgenic Model System. Department of Medicine Rounds, Stanford University, Stanford, CA, January 3, 2000.

18. Felsher, D. W. MYC Signaling in Normal and Pathological Processes. Stanford University, Stanford, CA, March 2, 2000.

19. Felsher, D. W. Reversible Tumorigenesis by MYC. Invited Speaker, UCSF Cancer Center, San Francisco, CA, May 5, 2000.

20. Felsher, D. W. Reversible Hepatocellular Carcinoma by MYC Using a Conditional Transgenic Model. Invited Speaker, 16th Annual meeting on Oncogenes and Tumor Suppressors, Salk Institute, La Jolla, CA, June 22-25, 2000.

21. Felsher, D. W. MYC Inactivation in Hematopoietic Tumors that have Lost P53 Still Regress, but Subsequently Relapse. The 42nd ASH Annual Meeting, San Francisco, CA December 2000.

22. Felsher, D. W. Reversible MYC-induced Tumorigenesis. Stanford University, Stanford, CA, October 9, 2000.

23. Felsher, D. W. Reversible Tumorigenesis by MYC Using a Conditional Transgenic Model System. University of Louisville, Louisville, Kentucky, November 6, 2000.

24. Felsher, D. W. Oncogene-induced Tumorigenesis is Reversible. AXYS Pharmaceuticals Seminar, San Francisco, CA, December 2000.

25. Felsher, D. W. MYC's Role in Signaling, Invited seminar. Stanford University, Stanford, CA, February 22, 2001.

26. Felsher, D. W. Reversing MYC-induced Tumorigenesis in a Transgenic Model. Invited seminar, DNAX, Palo Alto, CA, March 6th, 2001.

27. Felsher, D. W. Conditional Oncogene Expression in Transgenic Mice. Invited talk, The 2nd Gordon Research Conference, New London, NH, July 4, 2001.

28. Felsher, D. W. Defining When MYC Inactivation Induces Reversible Tumorigenesis. Salk/EMBL Oncogenes and Growth Control, La Jolla, CA, August 20, 2001.

29. Felsher, D. W. Reversing MYC-induced Tumorigenesis. Sunnybrook and Women's College Health Sciences Center, Toronto, Ontario Canada, March 27, 2001.

30. Felsher, D. W. Defining when Oncogenes will be Effective Therapeutic Targets for the Treatment of Cancer. Sunnybrook and Women's College Health Sciences Center, Toronto, Ontario Canada, March 27, 2001.

31. Felsher, D. W. The MYC Oncogene's Role in the Induction and Maintenance of Hepatocellular Carcinoma. Digestive Diseases Consortium Seminar, Stanford University, Stanford, CA, June 13, 2002.

32. Felsher, D. W. Permanent Loss of a Neoplastic Phenotype by Brief MYC Inactivation. SALK Oncogene meeting. San Diego, CA, June 22, 2002.

33. Felsher, D. W. Reversing MYC-Induced Tumorigenesis. Chiron Corporation, Emeryville, CA, September 13, 2002.

34. Felsher, D. W. Reversing MYC-Induced Tumorigenesis. Karolinska Hospital, Sweden, October 2, 2002.

35. Felsher, D. W. Reversing MYC-Induced Tumorigenesis. UCLA Department of Pathology, Grand Rounds, Los Angeles, CA, October 23, 2002.

36. Felsher, D. W. Reversing Cancer through Oncogene Inactivation. Stanford University, Stanford, CA, October 31, 2002.

37. Felsher, D. W. MYC's Role in the Induction and Maintenance of Tumorigenesis. Epithelial Biology Seminar. Stanford University, Stanford, CA, November 22, 2002.

38. Felsher, D. W., Deb-Basu, D., and Karlsson, A. Restoration of p27 Function Prevents MYC from Inducing Genomic Instability and Apoptosis. ASCB, San Francisco, CA, December 2002.

39. Felsher, D. W. Reversing MYC-Induced Tumorigenesis. SALK, La Jolla, CA, December 19, 2002.

40. Felsher, D. W. Reversing MYC-Induced Tumorigenesis. Cyternex, Inc., San Diego, CA, February 6, 2003.

41. Felsher, D. W. Oncogenes as Therapeutic Targets. Scheduling Program in Epithelial Biology Seminar Series, Stanford University, Stanford, CA, March 12, 2003.

42. Felsher, D. W. Cancer Revoked: Oncogenes as Therapeutic Targets. Tularik, Inc., San Francisco, CA, April 23, 2003.

43. Felsher, D. W. Reversing MYC-Induced Lymphomagenesis. FASEB, Saxtons River, Vermont, July 26-31, 2003.

44. Felsher, D. W. Reversing MYC-Induced Tumorigenesis. AVI BioPharma, Portland, OR, August 5, 2003.

45. Felsher, D. W. Cancer Revoked: Oncogenes as Therapeutic Targets. Charles Carrington Award Lecture. Stanford University, Stanford, CA, September 2003.

46. Felsher, D. W. Reversibility of Lymphomas. Swiss-German Hematology Meeting Marburg University, October 4-8, 2003.

47. Felsher, D. W. Reversibility of Lymphomas. Swiss German Hematology, Basel, Switzerland, October 7, 2003.

48. Felsher, D. W. Cancer Revoked: Oncogenes as Therapeutic Targets. University of Pennsylvania, Philadelphia, Pennsylvania, October 16, 2003.

49. Felsher, D. W. Cancer Revoked: Oncogenes as Therapeutic Targets. Grand Rounds, Stanford University, Department of Medicine, Stanford, CA, November 20, 2003.

50. Felsher, D. W. Cancer Revoked: Oncogenes as Therapeutic Targets. Signal Transduction 2004, Luxembourg, January 27, 2004.

51. Felsher, D. W. Cancer Revoked: Targeting Oncogenes to Treat Cancer. Nuclear Medicine Grand Rounds, Stanford University, Stanford, CA, March 16, 2004.

52. Felsher, D. W. Co-chair: Major symposium: The Malignant Phenotype: Stability and Reversibility. AACR, Orlando, Florida, March 27, 2004.

53. Felsher, D. W. Reversing Oncogene Induced Tumorigenesis. XV ZMBH FORUM, Heidelberg, Germany, May 7-9, 2004.

54. Felsher, D. W. Cancer Revoked: Oncogenes as Therapeutic Targets. Genentech Molecular Oncology, South San Francisco, CA, June 10, 2004.

55. Felsher, D. W. Reversing Oncogene Induced Tumorigenesis. King's College, London, England, August 11, 2004.

56. Felsher, D. W. Revoking Cancer Through Targeted Oncogene Inactivation. American Cancer Society, Los Gatos, CA, September 1, 2004.

57. Felsher, D. W. Lymphoma Revoked: Through Oncogene Inactivation. 3rd Mouse Models of Hematopoietic Malignancies Workshop. Memorial Sloan-Kettering Cancer Center, New York, NY, October 11-13, 2004.

58. Felsher, D. W. Reversing Oncogene-Induced Tumorigenesis. University of California San Francisco Cancer Center, San Francisco, CA, November 12, 2004.

59. Felsher, D. W. EMBO Molecular Medicine Meeting, Germany, November 28 – December 1, 2004.

60. Felsher, D. W. MYC Inactivation Uncovers Stem Cell Properties and Tumor Dormancy in Liver Cancer. Cell and Developmental Biology Faculty Talks. Stanford University, Stanford, CA, January 10, 2005.

61. Felsher, D. W. Conditional Mouse Models of Oncogene Induced Cancer. ICBP Meeting, Stanford University, Stanford, CA, January 11, 2005.

62. Felsher, D. W. Reversing MYC Induced Tumorigenesis. Keystone Symposia: Cancer and Development, Banf Canada, February 5-10, 2005.

63. Felsher, D. W. Cancer: A Genetic Paradigm in an Epigenetic Context. Stanford University, Department of Dermatology, Epithelial Biology Seminar, Stanford, CA, March 11, 2005.

64. Felsher, D. W. U.S. Japan Workshop, Animal Models for Hematologic Malignancies And Hematopoiesis. Maui Hawaii, March 22-26, 2005.

65. Felsher. D. W. Reversing Oncogene Induced Tumorigenesis. Organnon. Oss, Netherlands, April 11, 2005.

66. Felsher, D. W. Invited Talk: ASCI/AAP 2005 Joint Meeting, Chicago, Illinois, April 15-17, 2005.

67. Felsher, D. W. Methods Workshop: Conditional Oncogene Induced Tumorigenesis. AACR 96th Annual Meeting, Anaheim, CA, April 16-20, 2005.

68. Felsher, D. W. Targeting MYC to Reverse Lymphomagenesis. Damon Runyon Foundation, New York, May 1, 2005.

69. Felsher, D. W. Chair of Major Symposia: Oncogenes and Tumor Suppressor Genes: Tumor biology in the clinic. ASCO, Orlando Florida, May 13-17, 2005.

70. Felsher, D. W. ICBP Meeting, Integrative Cancer Biology Program NCI, Berkeley, CA, May 15-18, 2005.

71. Felsher, D. W. Molecular and Cellular Basis of Oncogene Addiction. Microbiology and Tumor Biology Center. Karolinska Institutet, Stockholm, Sweden, June 1, 2005.

72. Felsher, D. W. Tumor Dormancy: Cancer Genetics Put into an Epigenetic Context, June 3rd and Myc repair and genomic instability, June 4th, 10th. Congress of the European Hematology Association, Stockholm, Sweden, June 2005.

73. Felsher, D. W. Targeting MYC for the Treatment of Lymphoma. Lilly Research Laboratories, Indianapolis, Indiana, June 10, 2005.

74. Felsher, D. W. Molecular and Cellular Basis of Oncogene Addition. Dana Farber Cancer Institute, Harvard Medical School, Boston, MA, June 28, 2005.

75. Felsher, D. W. Reversing Hematopoietic Tumorigenesis. Gordon Research Conference, Rhode Island, July 2005.

76. Felsher, D. W. Reversing Oncogene Induced Tumorigenesis. SALK/EMBL Oncogene and Growth Control Meeting, Salk Institute, San Diego, CA, August 12-16, 2005.

77. Felsher, D. W. Molecular and Cellular Basis of Oncogene Addiction. University of Cincinnati, Cincinnati, OH, September 23, 2005.

78. Felsher, D. W. Imaging the Reversal of Tumorigenesis upon Oncogene Inactivation. Cancer and stem cells, Imaging 2020. Jackson Lodge, Wyoming, September 29, 2005.

79. Felsher, D. W. Digestive Disease Consortium, Stanford University, Stanford, CA, October 1, 2005.

80. Felsher, D. W. MYC Function and Liver Cancer Stem Cells. International Titisee Conference, Black Forest, Germany October 2005.

81. Felsher, D. W. Reversing Tumorigenesis. 100th Birthday Korea University Symposium, Seoul, Korea, November 3, 2005.

82. Felsher, D. W. Pushing Cancer to the Brink of Normalcy Through Oncogene Inactivation. 1st Joint Graduate Symposium, Cell Fate Decisions in Health and Disease, University of Wuerzburg, Germany, November 8, 2005.

83. Felsher, D. W. Molecular and Cellular Basis of Oncogene Addiction. Fred Hutchinson Cancer Center, Seattle WA, November 29, 2005.

84. Felsher, D. W. Molecular and Cellular Basis of Oncogene Addiction. Massachusetts General Hospital, Boston, MA, January 11, 2006.

85. Felsher, D. W. Molecular and Cellular Basis of Oncogene Addiction. Epithelial Biology Seminar Series, Stanford University, Stanford, CA, 2006.

86. Felsher, D. W. Molecular and Cellular Basis of Oncogene Addiction. PCCM Division, Stanford University, Stanford, CA, March 24, 2006.

87. Felsher, D. W. Molecular and Cellular Basis of Oncogene Addiction. Van Andel Institute, Grand Rapids, Michigan, April 12, 2006.

88. Felsher, D. W. Molecular and Cellular Basis of Oncogene Addiction. Dartmouth, Hanover, New Hampshire, May 10, 2006.

89. Felsher, D. W. Tumor Intrinsic and Host-Dependent Mechanisms of Oncogene Addiction. NCI Mouse Models of Human Consortium Meeting, Seattle, Washington, June 28, 2006.

90. Felsher, D. W. Molecular and Cellular Basis of Oncogene Addiction. IFOM-IEO, Campus, European Institute of Oncology, Milan, Italy, September 27, 2006.

91. Felsher, D. W. Molecular and Cellular Basis of Oncogene Addiction. ISREC, Switzerland, October 2, 2006.

92. Felsher, D. W. Oncogenes on Target to Treat Cancer. Molecular Pharmacology and Quantitative Chemical Biology Seminar, Stanford University, Stanford, CA, October 10, 2006.

93. Felsher, D. W. Molecular and Cellular Basis of Oncogene Addiction. Lymphoma Meeting, Palermo, Italy, October 2006.

94. Felsher, D. W. Mechanisms of Oncogene Addiction. Seminars in Oncology, Dana-Farber Cancer Institute and the Dana-Farber/Harvard Cancer Center, Boston, Massachusetts, October 17, 2006.

95. Felsher, D. W. Molecular and Cellular Basis of Oncogene Addiction. AACR Mouse Model Meeting, Cambridge Massachusetts, October 25, 2006.

96. Felsher, D. W. Liver Cancer Stem Cells. German, Austria and Swiss Society of Hematology and Oncology, Leipzig, Germany, November 4, 2006.

97. Felsher, D. W. Imaging Death and Resurrection of Cancer. Small Animal Imaging Symposium, Stanford University, Stanford, CA, November 15-18, 2006.

98. Felsher, D. W. Reversing Oncogene-Induced Tumorigenesis. Applied Biosystems, Foster City, CA, November 30, 2006.

99. Felsher, D. W. Molecular Basis of Oncogene Addiction. Oregon Health Sciences. Portland, Oregon, January 2007.

100. Felsher, D. W. Imaging the Death And Resurrection of Cancer. MIPS Seminar, Stanford University, Depart of Radiology/Nuclear Medicine, Stanford, CA, February 5, 2007.

101. Felsher, D. W. Molecular and Cellular Basis of Oncogene Addiction. Stanford University, Developmental Biology, Stanford, CA, March 5, 2007.

102. Felsher, D. W. Plenary Session on Mouse Models. AACR Annual meeting, Los Angeles, CA, April 2007.

103. Felsher, D. W. Educational Session: Validation of Targets/Models of Human Cancer. Molecular and cellular basis of oncogene addiction. AACR Annual Meeting, Los Angeles, CA, April 2007.

104. Felsher, D. W. Morning Session: Mouse Models of Cancer. AACR Annual Meeting, Los Angeles, CA, April 2007.

105. Felsher, D. W. The Role of Oncogenes in the Pathogenesis of Neoplasia. Tromso, Norway, April 2007.

106. Felsher, D. W. The Cellular and Molecular Basis of Oncogene Addiction. Karolinska Institute, Stockholm Sweden, April 2007.

107. Felsher, D. W. Reversing Tumorigenesis. Centro Nacional de Investigaciones Oncologicas, Madrid, June 2007.

108. Felsher, D. W. Imaging Tumor Regression upon Oncogene Inactivation. COBRA Meeting, August 24, 2007.

109. Felsher, D. W. Molecular and Cellular Basis of Oncogene Addiction. Pharmacology and Cancer Biology Lecture Series, Duke University, Durham, NC, September 2007.

110. Felsher, D. W. Modeling Oncogene Addiction and Oncogene Escape. ICBP Steering Committee Meeting, Washington DC, November 13-14, 2007.

111. Felsher, D. W. Reversing tumorigenesis. Translational Oncology Symposium, UCSD Cancer Center, La Jolla, CA November 16, 2007.

112. Felsher, D. W. Molecular and Cellular Basis of Oncogene Addiction. University of Manchester, England, November 28, 2007.

113. Felsher, D. W. Molecular and Cellular Basis of Oncogene addiction. Lankenau Institute of Medical Research, Philadelphia, Pennsylvania, December 13, 2007.

114. Felsher, D. W. Molecular and Cellular Basis of Oncogene Addiction. Abramson Family Cancer Research Institute, University of Pennsylvania, December 14, 2007.

115. Felsher, D. W. Molecular and Cellular Basis of Oncogene Addiction. University of California San Francisco, San Francisco, CA, January 25, 2008.

116. Felsher, D. W. Molecular and Cellular Basis of Oncogene Addiction. Ohio State, Columbus, Ohio, February 5, 2008.

117. Felsher, D. W. Molecular and Cellular Basis of Oncogene Addiction. UCSD Director’s Seminar Series, La Jolla, CA, February 13, 2008.

118. Felsher, D. W. Molecular and Cellular Basis of Oncogene Addiction. Celgene Corporation, San Diego, CA, February 28, 2008.

119. Felsher, D. W. ICBP Meeting, Columbus, OH, May 13-14, 2008.

120. Felsher, D. W. Mechanisms of Oncogene Addiction. Marburg, Germany, June 3, 2008.

121. Felsher, D. W. Gordon Conference, Rhode Island, July 28-August 1, 2008.

122. Felsher, D. W. Oncogene Addiction and a Dr Jekyll and Mr Hyde Model of Cancer. Dana Farber Cancer Institute, Boston MA, August 4, 2008.

123. Felsher, D. W. Drug Discovery and Innovative Therapeutics, Boston MA, August 6, 2008.

124. Felsher, D.W. Cancer Genetics & Epigenetics. Cold Spring Harbor Symposium, Cold Spring Harbor NY, August 13-17, 2008.

125. Felsher, D. W. Oncogenes and Cancer. Stanford Cancer Research Training Program, Stanford University, CA September 14, 2008.

126. Felsher, D. W. Nanoscale Proteomic Analysis of Clinical Cancer Specimens. Biomarker Discovery Summit 2008, Sixth Annual Protein Biomarker, Philadelphia PA, September 29-October 1, 2008.

127. Felsher, D. W. Mechanisms of Oncogene Addiction: A Dr Jeckyll and My Hyde model of tumorigenesis. Cell and Developmental Biology Faculty Lunch Series, Stanford University, Stanford, CA, November 3, 2008.

128. Felsher, D. W. Modeling Oncogene Addiction. Seminar IUH, Salle de Cours Batiment Inserm, Paris, France, December 12, 2008.

129. Felsher, D. W. Charite – Universitatsmedizin, Berlin, December 17, 2008.

130. Felsher, D. W. Non-Hodgkin Lymphoma (low Grade/indolent) & Waldenstrom's. Emerging Therapies for Blood Cancer Patients. Leukemia and Lymphoma Society, San Francisco, CA, January 31, 2009.

131. Felsher, D. W. Models and Modeling of Oncogene Addiction. Penn State Hershey Cancer Institute, Hershey, PA, March 9-11, 2009.

132. Felsher, D. W. Targeted Cancer Therapies. Keystone Symposia on Molecular and Cellular Biology, Whistler, British Columbia, Canada, March 27- April 4, 2009.

133. Felsher, D. W. Mouse Models of Liver Cancer. National Institute of Health, Bethesda, Maryland, April 9, 2009.

134. Felsher, D. W. Tumor Dormancy and Oncogene Addiction. AACR, Annual Meeting, Denver, Colorado, April 18-22, 2009.

135. Felsher, D. W. Reversing Cancer through Targeted Oncogene Inactivation. 2009 Annual Conference of the Chinese-American Bio/Pharmaceutical Society (CABS), San Francisco, CA, May 23, 2009.

136. Felsher, D. W. Mouse Models of Human Cancers. First Annual Center for Cancer Nanotechnology Excellence Symposium, Bechtel Conference Center, Stanford University, Stanford, CA, May 28-29, 2009.

137. Felsher, D. W. Proteomic Nanotechnology of Clinical Specimens Drug Discovery and Development. Keio Plaza Hotel, Japan, June 1, 2009.

138. Felsher, D. W. Modeling Oncogene Addiction. Molecular Therapeutics Research Association Meeting, Stanford, CA, July 19-22, 2009.

139. Felsher, D. W. The Expanding Role of Tet-Controlled Expression Models to Understand Oncogene Addiction and Malignant Progression. The EMBO Meeting, Amsterdam, August 29, 2009.

140. Felsher, D. W. MYC, Self-Renewal And Senescence. Gordon Research Conference: Stem Cells and Cancer, Switzerland, September 13-18, 2009.

141. Felsher, D. W. ADAPT Congress, Protein Biomarkers, The Grand Hyatt Washington, DC, September 22-25, 2009.

142. Felsher, D. W. Oncogene Addiction. Cell Regulation and Cancer. The Third Comprehensive Cancer Research Training Program at Stanford University (CCRTP-3), Menlo Park, CA, September 28- October 2, 2009.

143. Felsher, D. W. 2nd International Workshop on Cholangiocarcinoma and Hepatocellular Carcinoma, Washington, DC, October 6-7, 2009.

144. Felsher, D. W. Modeling Oncogene Addiction: Reversing Cancer from Inside And Out. Cancer Models and Mechanisms Symposium, Cancer Research UK, Cambridge, England, December 3-4, 2009.

145. Felsher, D. W. Molecular Modeling Oncogene Addiction. Lurie Cancer Center of Northwestern University, Chicago, IL, December 10, 2009.

146. Felsher, D. W. Bio-X/Novartis Meeting, James H. Clark Center, Stanford University, Stanford, CA, January 20, 2010.

147. Felsher, D. W. Modeling Oncogene Addiction for the Development of New Treatments for Cancer, Novartis, Emeryville CA, February 17, 2010.

148. Felsher, D. W. Molecularly Modeling and Predicting Oncogene Addiction in Lung Cancer, Bay Area Workshop on Lung Development, Physiology and Cancer, UCSF, San Francisco, CA, February 19, 2010.

149. Felsher, D. W. Targeting MYC Pathway for Cancer Treatment, SuperGen, Inc. Dublin, CA, March 22, 2010.

150. Felsher, D. W. c-Myc, as an Oncology Drug Discovery Target. Geron Corporation, Menlo Park, CA, March 24, 2010.

151. Felsher, D. W. Modeling and Predicting Oncogene Addiction. University of Toronto, Ontario Canada, April 9, 2010.

152. Felsher, D. W. Cancer Center's (ESAB) External Scientific Advisory Board Presentation, Stanford University, Stanford, CA, April 26, 2010.

153. Felsher, D. W. Modeling Oncogene Addiction. NIH/NCI Center for Cancer Research, Bethesda MD, May 3, 2010.

154. Felsher, D. W. Modeling Oncogene Addiction. ICBP Centers for Cancer Systems Biology Annual Meeting, Bethesda, MD, May 3-5, 2010.

155. Felsher, D. W. Modeling Oncogene Targeted Therapeutics. Agilent, Santa Clara, CA, June 21, 2010.

156. Felsher, D. W. Modeling of Oncogene Addiction in Transgenic Mouse Models. Cold Spring Harbor Laboratory Meeting, Mechanisms & Models of Cancer, Cold Spring Harbor, NY, August 17-21, 2010.

157. Felsher, D. W. Molecular Therapies that Target Oncogenes. Stanford Cancer Center CCRTP Course, Stanford, CA, September 14, 2010.

158. Felsher, D. W. Nanoscale Proteomics in Cancer. ADAPT Biomarker Meeting, Arlington, VA, September 15-16, 2010.

159. Felsher, D. W. Seminars in Oncology Lecture Series, Dana-Farber Cancer Institute and the Dana-Farber/Harvard Cancer Center, Boston, MA, September 21, 2010.

160. Felsher, D. W. AACR Molecular Diagnostics, Denver, CO, September 27-30, 2010.

161. Felsher, D. W. Advances in Oncology, Greece, October 7-9, 2010

162. Felsher, D. W. 2010 NanoPro User Meeting, Washington DC, October 13-15, 2010.

163. Felsher, D. W. Modeling Oncogene Addiction Inside Out. Columbia University, New York City, NY, November 8, 2010.

164. Felsher, D. W. Oncogene Addiction: Inside and out. Memorial Sloan Kettering Cancer Center, New York, NY, November 9, 2010

165. Felsher, D. W. Oncogene Addiction Inside Out. University of Arizona, Tucson, AZ, November 22, 2010.

166. Felsher, D. W. Targeting the MYC Pathway to Reverse Cancer. SuperGen, Inc., Salt Lake City, UT, January 19, 2011.

167. Felsher, D. W. Multi-Scale Modeling to Predict Therapeutic Response in Lung Cancer. Pulmonary Medicine and Biology Grand Rounds, Stanford University School of Medicine, Stanford, CA, February 11, 2011.

168. Felsher, D. W. Nanoscale Analysis of Oncogene Addiction. Genentech, San Francisco, CA, March 9, 2011.

169. Felsher, D. W. Modeling and Predicting Oncogene Addiction. 16th International AEK Cancer Congress, Duesseldorf, Germany, March 16-18, 2011.

170. Felsher, D. W. Modeling Oncogene Addiction. Amgen, Thousand Oaks, CA, March 21, 2011.

171. Felsher, D. W. Modeling Oncogene Addiction. Systems Biology Conference, Stanford University, Stanford, CA, May 2-3rd, 2011.

172. Felsher, D. W. Oncogene Addiction Inside And Out. Molecular Biology, Microbiology and Biochemistry Seminar Series, Southern Illinois University, Carbondale, IL, May 6, 2011.

173. Felsher, D. W. Modeling Tumor Dormancy, Dormancy Workshop, Boston MA, July 25-28, 2011.

174. Felsher, D. W. Cancer Therapy and Biomarkers. CCRTP Conference, Stanford, CA, September 14-16th, 2011.

175. Felsher, D. W. Reversing Tumorigenesis through Targeted Oncogene Inactivation. 16th World Congress on Advances in Oncology, Athens Greece, October 6-8, 2011.

176. Felsher, D. W. MYC as a Therapeutic Target. MYC and the Pathway to Cancer. Cold Spring Harbor, NY, November 6-9, 2011.

177. Felsher, D. W. Modeling Oncogene Addiction. Cancer Conference 2011. From Carcinogenesis to Cancer Therapy, Xcaret Mexico, November 9-13, 2011.

178. Felsher, D. W. International Society for Cellular Oncology 2012 Congress, Mallorca Spain, March 4-8, 2012.

179. Felsher, D. W. Modeling and Predicting Oncogene Addiction. Karolinska Institutet, Frontiers in Cancer Research and Therapy, Stockholm, Sweden, March 8-9, 2012.

180. Felsher, D. W. Targeting MYC for the Treatment of Cancer. Geron Corporation, Menlo Park, CA, March 21, 2012.

181. Felsher, D. W. Modeling and Predicting Oncogene Addiction. St. Jude Children's Research Hospital, Memphis, TN, March 28, 2012.

182. Felsher, D. W. Modeling Oncogene Addiction. MDC Systems Biology Meeting, Berlin, Germany, July 2012.

183. Felsher, D. W. Noncanonical Role the Immune Systems in Oncogene Addiction. MDC, Berlin, Germany, July 2012.

184. Felsher, D. W. Modeling and Measuring Oncogene Addiction. MD Anderson, Houston, TX, August 22, 2012.

185. Felsher, D. W. Funding Your Research, Stanford Translational and Applied Medicine Program, Stanford, CA, October 10, 2012.

186. Felsher, D. W., Oncogene Addiction and the Immune System, SITC Workshop, Bethesda, MD, October 24-25, 2012

187. Felsher, D. W. Modeling Oncogene Addiction, 5th Annual Beth Israel Deaconess Cancer Center Symposium, Boston, MA, 2012.

188. Felsher, D.W. IT2012: Therapeutic Manipulation of Inflammatory Microenvironment, Cuba, November 2012

189. Felsher D. W. Modeling and Predicting Oncogene Addiction, RECOMB Systems Biology Meeting, November 2012.

190. Felsher, D.W. Modeling and Predicting the Efficacy of Targeted Oncogene Inactivation, MD Anderson Cancer Medicine Grand Rounds, Houston, TX, January 2013

191. Felsher, D. W. Modeling and Predicting Oncogene Addiction, University of Freiberg, Germany, February 2013.

192. Felsher, D. W. Modeling Oncogene Addiction, University of Massachusetts, Worcester, MA, March 2013.

193. Felsher, D. W. Imaging the Immune System, AACR SNMI Molecular Imaging, San Diego, CA, February 27-March 2, 2013.

194. Felsher, D. W. Bone Marrow Mesenchymal Stem Cells as Possible Niche for Dormant Tuberculosis, ID Grand Rounds, Stanford University, March 14, 2013.

195. Felsher, D. W. Novel Biological Measurements to Detect, Predict and Prevent Human Disease, Johns Hopkins School of Public Health, Baltimore, MD, March 22, 2013.

196. Felsher, D. W. Modeling Oncogene Addiction, AFCR/Heme-Onc Seminar, University of Pennsylvania Cancer Center, Philadelphia, PA, March 26, 2013.

197. Felsher, D. W. Modeling and Predicting Oncogene Addiction. USC PSOC Seminar Series, Los Angeles, CA, April 26, 2013.

198. Felsher, D. W. Modeling Oncogene Addiction, Stanford Center for Cancer Systems Biology Annual Symposia, Stanford, CA, May 3, 2013.

199. Felsher, D. W. Modeling and Predicting Oncogene Addiction, Centre de Recherche en Cancerologie de Marseille, France, June 2013.

200. Felsher, D. W. Modeling and Predicting Oncogene Addiction, Royal Swedish Academy of Science, Stockholm, Sweden, September 1-3rd, 2013.

201. Felsher, D. W. Targeting MYC to Suppress Self-Renewal Programs in Cancer. Bone Marrow Failure Seminar, Stanford University, November 22, 2013.

202. Felsher, D.W. Modeling Oncogene Addiction. Cancercon2014, Chennai, India, January 30-February 2, 2014.

203. Felsher, D. W. Modeling Oncogene Addiction. Pediatric Oncology Research Conference, Stanford, CA, February 14, 2014.

204. Felsher, D. W. Modeling and Predicting Oncogene Addiction. Roswell Park Cancer Institute Distinguished Speaker, Buffalo, NY, March 12, 2014.

205. Felsher, D. W. Modeling Oncogene Addiction. 19th World Congress on Advances in Oncology and 17th International Symposium on Molecular Medicine, Metropolitan Hotel, Athens, Greece, October 9-11, 2014.

206. Felsher, D. W. Oncogene Addiction and the Immune System. CSHL Banbury Meeting, Cold Spring Harbor, NY, 2014.

207. Felsher, D. W. Modeling and Predicting Oncogene Addictions. Vanderbilt University Medical Center, Nashville, TN, January 22, 2015.

208. Felsher, D. W. Modeling and Predicting MYC Addiction. Roche Pharmaceuticals, Basel, Switzerland, February 13, 2015.

209. Felsher, D. W. Modeling Oncogene Addiction. UCSF Helen Diller Family Comprehensive Cancer Center Friday Seminar Series. UCSF, San Francisco, CA April 17, 2015.

210. Felsher, D. W. Childhood Liver Tumours Strategy Group, SIOPEL Meeting. Oslo, Norway, April 24-25, 2015.

211. Felsher, D. W. Modeling and Predicting Oncogene Addiction. Biozenrums Kolloquium Series, University of Wurzburg, Germany, May 20, 2015.

212. Felsher, D. W. Oncogene Addiction and Metabolism. AACR Special Conference: Metabolism and Cancer. Hyatt Regency Bellevue, Washington, June 7-10, 2015.

213. Felsher, D. W. Nanoscale Proteomics. Progenity, San Diego, CA. July 8, 2015.

214. Felsher, D. W. Modeling and Predicting Oncogene Addiction, University of Maryland Greenebaum Cancer Center, Baltimore, MD. November 18, 2015.

215. Felsher, D. W. Modeling and Predicting MYC Oncogene Addiction. MIT Koch Institute, Cambridge, MA. December 14, 2015.

216. Felsher D. W. Modeling and Predicting Oncogene Addiction, Harvard, Boston Children's Hospital, Boston, MA, December 15, 2015.

217. Felsher, D. W. The MYC Oncogene Regulator of Immune Checkpoints and Immune Surveillance. Weill Cornell Medical College Stem Cell Research and Regenerative Medicine, New York City, NY, April 11, 2016.

218. Felsher, D. W. Modeling and Predicting Oncogene Addiction, Hebron Institute, Barcelona, Spain, April 22, 2016.

219. Felsher, D. W. Predicting Metastasis, SIOPEL Meeting, Barcelona, Spain, April 22, 2016.

220. Felsher, D. W. Speaker: "Remodeling the Tumor Microenvironment through Oncogene Inactivation" AACR Annual Meeting, Chair of Symposia: Cancer Prevention through Modulation of the Tumor Microenvironment, New Orleans, LA, April 16-20, 2016.

221. Felsher, D. W. Oncogene Addiction, NIH CCR Eminent Lecture Series, Bethesda, MD, May 23, 2016.

222. Felsher, D. W. CSHL Course Seminar, Conditional Mouse Models, Cold Spring Harbor, NY, June 22, 2016.

223. Felsher, D. W. Oncogene Addiction and the Immune system, International Symposium in Molecular Medicine, Athens, Greece, October 6, 2016.

224. Felsher, D. W. Keynote Speaker, Oncology: Challenges and Opportunities, Sichuan Maternal and Child Health Hospital, Sichuan Sheng, China, November 11, 2016.

225. Felsher, D. W. Keynote Speaker, Oncology: Challenges and Opportunities, West China Medical School Sichuan University, Sichuan China, November 12, 2016.

226. Felsher, D. W. Keynote Speaker, Oncology: Challenges and Opportunities, Liuzhou Workers Hospital, Liuzhou China, November 15, 2016.

227. Felsher, D. W. The MYC Oncogene Globally Regulates the Immune Response, University of Miami Cancer Center, Miami, FL, February 9, 2017.

228. Felsher, D. W. Senescence & Aging Mini-Symposium, MYC Global Regulator Stemness versus Self-Renewal, Cancer Center & Cancer Research Institute Beth Israel Deaconess Medical Center, Boston, MA, March 7, 2017.

229. Felsher, D. W. Symposium on Tumor Motility, University of Freiberg, Germany, March 21-25, 2017.

230. Felsher, D. W. MYC Regulates the Immune Response, Major Symposium, AACR Annual Meeting, Washington DC, April 2, 2017.

231. Felsher, D. W. MYC Regulates the Immune Response, Keynote Speaker, University of Arizona Cancer Center Retreat, Tucson, AZ, April 21, 2017.

232. Felsher, D. W. Oncogene Addiction: A Paradigm for Translational Medicine, University of Maryland, College Park, MD, May 2, 2017.

233. Felsher, D. W. Oncology: Challenges and Opportunities, Speaker, Sichuan Cancer Hospital and Institute, China, May 9, 2017.

234. Felsher, D. W. Oncology: Challenges and Opportunities, Speaker, Beijing University of Chinese Medicine, China, May 10, 2017.

235. Felsher, D. W. Oncology: Challenges and Opportunities, Speaker, Chinese PLA General Hospital, China, May 10, 2017.

236. Felsher, D. W. Oncology: Challenges and Opportunities, Speaker, Taizhou Medical School, China, May 13, 2017.

237. Felsher, D. W. Characteristic Therapy Workshop for Traditional Chinese Medicine, Oncology: Challenges and Opportunities, Speaker/Chair, US Center for Chinese Medicine, Rockville MD, May 24, 2017.

238. Felsher, D. W. Liver Mini-Symposium, UCSF, San Francisco, CA, September 22, 2017.

239. Felsher, D. W. Roche Pharmaceuticals, San Francisco, CA, October 10, 2017.

240. Felsher, D. W. TRAM, Translational Research and Applied Medicine Program: Perspectives on Future of Translational Medicine, Stanford, CA, November 3, 2017.

241. Felsher, D.W. Societies of Biosciences of Argentina, Buenos Aires, Argentina, November 13th-19th, 2017.

242. Felsher, D. W. Modeling Metastasis in Hepatocellular Carcinoma, December 7-10th, Liver Meeting, 2017.

243. Felsher, D.W. Keynote Speaker, Cancercon, Chennai, India, Feb 1-2nd, 2018.

244. Felsher, D. W. Frontiers in Targeting MYC: Expression, Regulation, and Degradation. NIH campus, Bethesda, MD, April 9-10, 2018.

245. Felsher, D. W. The MYC Oncogene is a Global Regulator of the Immune Response, AACR Cancer Dormancy and Residual Disease, Montreal, QC, Canada, June 19-22, 2018.

246. Felsher, D. W. Invited Speaker, Conference Cancer and Environmental Mixtures. University of California Campus in Berkeley CA, August 21-22, 2018.

247. Felsher, D. W. Chinese Society of Clinical Oncology, Cancer Genomics Meets Immuno-Oncology: The Story of Myc. Xiamen China, September 2018.

248. Felsher, D. W. Modeling and Predicting Oncogene Addiction, MBICR Dedication, Chengdu China, October 8-15, 2018.

249. Felsher, D. W. Liver Cancer Symposium, Stanford University, Stanford, CA, October 17-18, 2018.

250. Felsher, D. W. Cancer Prevention and Therapy through Natural Products, Harvard Chinese Medicine Meeting, Harvard Medical School, Boston, MA, October 29-30, 2018.

251. Felsher, D. W. Keynote Speaker, GI Cancer Meeting, Guangzhou, November 7-12, 2018.

252. Felsher, D. W. MYC Master Regulator of the Immune System, Wurzburg, Germany, November 14, 2018.

253. Felsher, D. W. Invited Presentation, Milan, Italy, December 12-16, 2018.

254. Felsher, D. W. MYC is a Global Regulator of the Immune Response, Ludwig Cancer Center, Lausanne, Switzerland, January16, 2019.

255. Felsher, D. W. MYC is a Hallmark of Tumor Initiation and Maintenance, EPFL, Lausanne Switzerland, January 17, 2019.

256. Felsher, D. W. Invited Speaker, Conference Cancer and Environmental Mixtures. University of California Campus in Berkeley CA, February 6-7, 2019.

257. Felsher, D. W. Novel Therapeutics for Myc-Driven Cancer, SPARK, Stanford, CA, March 7, 2019

258. Felsher, D. W. The MYC Oncogene is a Global Regulator of the Immune Response to Cancer, Winship Cancer Institute of Emory University, Atlanta, Georgia, March 27, 2019.

259. Felsher, D. W. Trajectory of a Physician Scientist: The Usual and Unusual Suspects for Funding Opportunities, ReCAP Presentation, Stanford University, Stanford, CA, April 5, 2019.

260. Felsher, D. W. Targeting Specific Oncogenic Pathways to restore the Immune Response Against Cancers, World Vaccine Congress Washington 2019, Washington DC, April 14-17, 2019.

261. Felsher, D. W. Cancer Hallmarks: An Approach to Understanding the Biology of Tumorigenesis, Converging on Cancer Workshop, Washington D.C., April 29-30, 2019.

262. Felsher, D. W. The MYC Oncogene is a Global Regulator of the Immune Response, John Hart Lecture in Cancer Research, Northwestern University, Evanston, IL, May 23, 2019.

263. Felsher, D. W. MYC is a Global Regulator of the Immune Response, Amsterdam, European Hematology Association, June 13-16, 2019.

264. Felsher, D. W. MYC Regulates the Immune Response, Saint-Louis Hospital, Hematology Seminars, Paris, France, June 17, 2019.

265. Felsher, D. W. Invited speaker, FASEB, Lisbon, Portugal, July 21-26, 2019.

266. Felsher, D. W. Invited speaker, A Platform for Identifying Strategies for Reversing Cancer and Restoring the Immune Response, 2019 LakePharma Symposium on Next-Generation Therapeutics, San Francisco, CA, October 10, 2019.

267. Felsher, D. W. Invited speaker, Reversible Cancer by Targeting Oncogenes through Natural Products, BUCM Conference, Shenzhen China, December 12-17, 2019.

Case 23-12825-MBK Doc 31-16 Filed 04/04/23 Entered 04/04/23 18:09:20 Desc
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Felsher, D. W. Invited speaker, Universal Cancer Screening Summit, Mayo Clinic, Rochester, MN, February 3-4, 2020.

268. Felsher, D. W. Invited speaker, UCSD for Translational Medicine Day, San Diego, CA, March 11, 2020.

269. Felsher, D. W. Invited speaker, Stanford University TRAM Seminar MED121/221, Introduction to Translational Research and Applied Medicine: Pre-Clinical to Clinical Transition, Stanford, CA, September 30, 2020.

270. Felsher D. W. Targeting Cancer through the MYC Oncogene, Oppenheimer Biotech Emerging Science, virtual, Summit meeting, featuring Stanford University's SPARK Program, Friday, October 9, 2020.

271. Felsher, D. W. MYC and the Tumor Microenvironment. Prostate Cancer Foundation Annual Retreat, October 22, 2020

272. Felsher, D. W. Targeting MYC Oncogene Pathway: Global Gatekeeper of Tumor Growth and Immune Evasion. PBSS online Immuno-oncology Symposium. August 11-12, 2021.

273. Felsher, D. W. Oncogene Addiction, Frontiers in Clinical Translation Seminar Series, Stanford University, Stanford, CA, September 14, 2021.

274. Felsher, D. W. Introduction to TRAM: Translating Cancer Research, Translational Research and Applied Medicine (TRAM), Stanford University, Stanford, CA, September 29, 2021.

275. Felsher, D. W. Invited speaker, Translational Oncology: New Treatments for Cancer, Beijing China conference (zoom), December 11, 2021.

276. Felsher, D. W. Eppley Institute for Research in Cancer and Allied Diseases, Eppley Seminar, University of Nebraska Medical Center, Omaha, Nebraska. April 7, 2022.

277. Felsher, D. W. American Society of Gene & Cell Therapy, AVV Vector Integrations in Human Hepatocytes in Liver-Targeted Gene Therapy, Annual Meeting (hybrid), Washington, DC, May 15, 2022.

Exhibit B

H&P by Shieh, Tim Han, PA at 2/15/2022 12:30 AM (continued)

Recent Labs

	02/14/22 0551
Sodium, Ser/Plas	138
Potassium, Ser/Plas	4.1

Diabetes :
Hematologic :
Nutrition : per dietitian:
BMI from flowsheet: 33.2

Malignancy : Primary malignancy of lungs (site) Confirmed
Functional Status :

Tim Shieh, PA-C
Cardiothoracic Surgery

Electronically signed by Boyd, Jack H, MD at 2/24/2022 1:31 PM

Operative Report signed by Boyd, Jack H, MD at 3/8/2022 4:57 PM

Author: Boyd, Jack H, MD | Service: Cardiac Surgery | Author Type: Physician
Filed: 3/8/2022 4:57 PM | Date of Service: 2/17/2022 6:00 PM | Note Type: Operative Report
Status: Signed | Editor: Boyd, Jack H, MD (Physician)

DATE OF OPERATION: 02/17/2022

PREOPERATIVE DIAGNOSES:
1. Pericardial mesothelioma.
2. Bilateral pleural effusions.
3. Pericardial constriction.

POSTOPERATIVE DIAGNOSES:
1. Pericardial mesothelioma.
2. Bilateral pleural effusions.
3. Pericardial constriction.

OPERATION PERFORMED:
1. Pericardiectomy (33030).
2. Bilateral PleurX catheters performed by Dr. Backhus.
3. Resection of mediastinal mass performed by Dr. Backhus.

EXHIBIT B

Case 21-30589-MBK Doc 2318-16 Filed 05/04/22 Entered 05/04/22 18:09:20 Desc Exhibit Exhibit 28 to A Batterby Declaration - PART 1 Page 74 of 106

SURGEON: Jack H Boyd, MD

SURGEON: Leah M Backhus, MD.

CO-SURGEON: Jack H Boyd, MD.

SURGERY RESIDENT: Irmina A Elliott, MD

ASSISTANT: Jessica C Warner, PA-C

INTRAOPERATIVE FINDINGS:
1. Large bilateral chylothoraces.
2. Diffuse tumor involvement of the pericardium with areas of invasion into the myocardium.

INDICATION FOR SURGERY: Anthony Hernandez is a 23-year-old male with the above diagnoses. He has been offered palliative pericardiectomy and mass excision as well as PleurX catheter placement. The risks, benefits, and alternatives were discussed. All questions were answered. Informed consent was obtained.

DESCRIPTION OF PROCEDURE: Please refer to Dr. Backhus' separate note for her portions of the procedure.

The patient was brought to the operating room, placed in the supine position on the operating table. Femoral lines were placed, and then general anesthesia was induced. The patient was intubated and the appropriate monitoring lines and catheters were placed. The patient was then prepped and draped in normal sterile fashion. A median sternotomy was performed. Both pleural spaces were opened widely and large quantities of chylous effusion were removed by suction approximately 5-6 L in total. We then began by excising all the mediastinal fat and then attempted to open the pericardium in several places before finding an area overlying the right ventricle. We then slowly removed after identifying the proper plane, removed as much pericardium as we could from around the right atrium over the right ventricle and out toward the left ventricular apex. There were areas of direct tumor involvement into the heart and these areas were spared. All in all from nearly right phrenic to the left phrenic with about 2 cm on either side from the level of the diaphragm up to the aorta the vast majority of the pericardium with tumor involved was resected. After completing the pericardiectomy and a thymectomy with other mediastinal fat excision by Dr. Backhus, it was determined this should complete the extent of our resection. During the surgery, the patient's CVP decreased from the high 20s to low 20s. The pulmonary pressures dropped nearly in half from a

Operative Report signed by Boyd, Jack H, MD at 3/8/2022 4:57 PM (continued)

systolic of 60 to a systolic in the low 30s and the cardiac output doubled. Drainage catheters were placed. Dr. Backhus and her team placed PleurX catheters and the chest wall was closed in the standard fashion. Needle, sponge, and instrument counts were correct. Pre and postoperative time-outs were performed. I was present and scrubbed for the procedure.

Jack H Boyd, MD

CC: Han Zhu, MD

Fatima Rodriguez, MD

Mohana Roy, MD

D: 02/18/2022 13:30:53 T: 02/18/2022 14:02:56 / MODL
SJN: 947455498 DJN: 354233

Electronically signed by Boyd, Jack H, MD at 3/8/2022 4:57 PM

Operative Report by Backhus, Leah Monique, MD at 2/17/2022 10:00 PM

Author: Backhus, Leah Monique, MD	Service: Thoracic Surgery	Author Type: Physician
Filed: 2/20/2022 5:27 PM	Date of Service: 2/17/2022 10:00 PM	Note Type: Operative Report
Status: Addendum	Editor: Backhus, Leah Monique, MD (Physician)	

Related Notes: Original Note by Elliott, Irmina A, MD (Fellow) filed at 2/20/2022 12:34 PM

DATE OF OPERATION: 02/17/2022

PREOPERATIVE DIAGNOSES:
1. Pericardial mesothelioma.
2. Bilateral pleural effusions.
3. Pericardial constriction.

POSTOPERATIVE DIAGNOSES:
1. Pericardial mesothelioma.
2. Bilateral pleural effusions, chylothoraces.
3. Pericardial constriction.

OPERATION PERFORMED:
1. Pericardiectomy (performed by Dr. Boyd)
2. Bilateral PleurX catheters

3. Resection of mediastinal mass and thymectomy

SURGEON: Leah M Backhus, MD.
CO-SURGEON: Jack H Boyd, MD.

SURGERY RESIDENT: Irmina A Elliott, MD

ASSISTANT: Jessica C Warner, PA-C

INTRAOPERATIVE FINDINGS:
1. Large bilateral chylothoraces.
2. Diffuse tumor involvement of the pericardium with areas of invasion into the myocardium.

INDICATION FOR SURGERY: Anthony Hernandez is a 23-year-old male with pericardial mesothelioma. He has been offered palliative pericardiectomy for tumor debulking with the hope of relieving his shortness of breath as well as PleurX catheter placement. The risks, benefits, and alternatives were discussed. All questions were answered. Informed consent was obtained.

DESCRIPTION OF PROCEDURE: Please refer to Dr. Boyd's separate note for his portions of the procedure. The patient was brought to the operating room, placed in the supine position on the operating table. Before induction of general anesthesia, an ultrasound-guided sheath was placed in the left common femoral artery and right common femoral vein. General anesthesia was induced and the patient was then prepped and draped in the usual sterile fashion.

As indicated in Dr. Boyd's note, a median sternotomy was made. The pleural spaces were opened and what appeared grossly to be bilateral chylous effusions were evacuated totally 4-5 Liters of fluid. Partial pericardiectomy was performed. We then proceeded with thymectomy, dissecting the pericardial fat and thymus free from the pericardial surface from the level of the diaphragm to above the innominate vein, taking care not to injure the phrenic nerves. The draining thymic veins were ligated with clips and divided. Of note, the thymus and pericardial fat were nodular and thickened, containing areas of tumor. We then placed bilateral tunneled PleurX catheters. Incisions were made at appropriate exit sites, and the catheters positioned using the tunneler with the cuff just within the exit incision. We also placed bilateral straight chest tubes and a mediastinal tube.

The chest wall was closed in the standard fashion. Needle, sponge, and instrument counts were correct. Pre and postoperative time-outs were performed.

Surgical Teaching Physician Attestation
I was present, scrubbed and directly participated in the entire surgical procedure detailed above.

Leah Monique Backhus, MD
Thoracic Surgery

Electronically signed by Backhus, Leah Monique, MD at 2/20/2022 5:27 PM

Documentation Clarification by Novack, Michael Raedy, MD at 2/18/2022 10:29 AM

Case 23-12825-MBK Doc 748-17 Filed 06/12/23 Entered 06/12/23 08:09:20 Desc
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Exhibit C

Committee on CARCINOGENICITY

CC/13/S1

COMMITTEE ON CARCINOGENICITY OF CHEMICALS IN FOOD, CONSUMER PRODUCTS AND THE ENVIRONMENT

STATEMENT ON THE RELATIVE VULNERABILITY OF CHILDREN TO ASBESTOS COMPARED TO ADULTS.

Executive Summary

I. We were asked for advice on the relative vulnerability of children to asbestos to inform the discussions of the independent "Asbestos in Schools Steering Group" of the Department for Education (DfE). There are two key components to assessing children's vulnerability to asbestos. These are 1) the effect of age at exposure and life expectancy and 2) a child's intrinsic susceptibility to injury. Accurate definitions of the terms "susceptibility", "sensitivity" and "vulnerability" were integral to the discussion. We considered the following information: relevant epidemiological studies, animal studies, levels of exposure which children may experience, and anatomical and physiological differences between children and adults.

II. There are 24,372 schools in England and it is estimated that more than 75% of these schools have some buildings which contain asbestos-containing products (ACPs). If buildings contain ACPs, there is increased potential for occupants, including children, to be exposed to asbestos. When asbestos is present and is disturbed or damaged, exposure can increase.

III. All forms of asbestos are carcinogenic to humans, causing mesothelioma and cancer of the lung, larynx, and ovary. From an epidemiological perspective, there is good evidence that childhood exposure to asbestos can cause mesothelioma in later life.

IV. There are respiratory and immunological differences between adults and children but their impact on the susceptibility of children to asbestos-induced cancer is unclear.

V. From the available, albeit limited, data it is not possible to say whether children are intrinsically more susceptible to asbestos-related injury. However, it is well recognised by this committee that, due to the increased life expectancy of children compared to adults, there is an increased lifetime risk of mesothelioma as a result of the long latency period of the disease. Because of differences in life expectancy, for a given dose of asbestos the lifetime risk of developing mesothelioma is predicted to be about 3.5 times greater for a child first exposed at age 5 compared to an adult first exposed at age 25 and about 5 times greater when compared to an adult first exposed at age 30. In reaching our evaluation and taking into consideration that

EXHIBIT C

there are a number of uncertainties and data gaps, we conclude that exposure of children to asbestos is likely to render them more vulnerable to developing mesothelioma than exposure of adults to an equivalent asbestos dose.

Background and Terms of Reference

1. In 2011, the Department for Education (DfE) sought advice from the Committee on Carcinogenicity (COC) on the relative vulnerability of children to asbestos. This request arose from discussions in an independent advisory group called the "Asbestos in Schools Steering Group", which reports to the DfE. This Steering Group aims to promote effective management of asbestos in schools and to contribute to the development of guidance on such management. DfE subsequently asked the Department for Health (DH) for an evaluation of the risk of asbestos to children and DH facilitated this request by referral to the COC.

Strategy

2. The information assessed by the Committee included –

i) An evaluation of the available epidemiology literature on childhood exposure to asbestos and risk of mesothelioma in later life.

ii) A review of the available animal studies investigating the comparative changes and consequences of juvenile exposure to asbestos compared to those from exposure in later life.

iii) A discussion on the differences between children and adults in relation to respiratory physiology, inflammation and dosimetry.

iv) Information on the levels of asbestos to which children may be exposed, in particular in school buildings and in residential properties.

v) Consideration of the WATCH statement and of their deliberations on low level exposure to asbestos for background information into the subject matter (http://www.hse.gov.uk/aboutus/meetings/iacs/acts/watch/240211/asbestos-final-position-statement.pdf). WATCH is a Health and Safety Executive (HSE) committee, which advises the Advisory Committee on Toxic Substances (ACTS) and HSE on scientific and technical issues relating to the assessment and control of health risks from chemicals.

A number of health and other experts were consulted by the Committee. Appendix A provides a list of these professionals, and of other individuals who provided oral and written information to the COC on this item.

3. From the outset, we agreed that two factors required careful consideration, when assessing children's vulnerability to asbestos. These were 1) the effect of age at exposure and life expectancy and 2) a child's intrinsic susceptibility to injury. A clear understanding of the term "vulnerability" was integral to the discussion. The following definitions of "susceptibility", "sensitivity" and "vulnerability" are based on Hines et al. (2010); they reflect the Committee's understanding of the terms and are used accordingly throughout. Susceptibility is defined as a capacity characterized by

biological (intrinsic) factors that can modify the effect of a specific exposure, leading to an altered health risk at a given relevant exposure level. Sensitivity describes the capacity for higher risk due to the combined effect of susceptibility (biological factors) and differences in exposure. Vulnerability incorporates the concepts of susceptibility and sensitivity, as well as additional factors that include social and cultural parameters (e.g., socio-economic status and location of residence) that can contribute to an altered health risk. We agreed that consideration should be given to all children up to school leaving age.

Asbestos

4. Asbestos is the name given to a group of six different fibrous minerals that occur naturally in the environment: chrysotile (white asbestos), amosite (brown asbestos), crocidolite (blue asbestos), and the fibrous varieties of tremolite, actinolite, and anthophyllite. Chrysotile belongs to the serpentine family of minerals, while all of the others belong to the amphibole family. Asbestos minerals consist of thin, separable fibres that have a parallel arrangement. Amphibole asbestos fibres are generally brittle and often have a rod- or needle-like shape, whereas chrysotile asbestos fibres are flexible and curved. The term "regulated asbestos fibres" encompasses chrysotile, amosite, crocidolite, tremolite, actinolite or anthophyllite fibres with a length to width ratio (aspect ratio) of at least 3:1 and a length of 5 micrometres (µm) or more, which are visible in the phase-contrast optical microscope (PCM) at a magnification of at least 500 (Control of Asbestos at Work Regulations UK (CAWR, 2012). Annex A details the different types of asbestos.

Sources of asbestos in the UK

5. Over 5.3 million tonnes of asbestos have been imported into the UK since the 1940s, peaking between the 1960s and mid-1970s and then falling sharply. Historically, chrysotile was the main type of asbestos imported into the UK (around 95% of all asbestos imported) but between the late 1950s to the mid-1970s in excess of 20,000 tonnes of amosite were imported annually, approximately 15% of the asbestos imported in this period. Crocidolite imports were around 6000 tonnes per year from 1950 to the early 1960s, constituting around 5% of the total asbestos imported (Asbestos Information Centre UK website, http://www.aic.org.uk/Asbestos_imports.htm). Asbestos was extensively used in a wide range of manufactured products (more than 3,000) in the UK from the 1950s through to the mid-1980s, mostly in building materials, friction products, and heat-resistant fabrics, because of its sound absorption, average tensile strength, its resistance to fire, heat, electrical and chemical damage, and affordability. The importation, supply and use of amosite and crocidolite were banned in 1985 and of chrysotile in 1999. However, due to its earlier extensive use, asbestos is still present in buildings such as schools, houses, flats and offices built prior to 2000 and in products manufactured before the bans. UK residents, including children, are potentially exposed to asbestos from such buildings. Consideration must also be given to low level exposure from ambient[1] levels indoors and outdoors.

[1] Ambient is defined as "the normal conditions surrounding a person, i.e. sampling location" http://ieh.cranfield.ac.uk/ighrc/cr10.pdf

6. Asbestos is present in the three main environmental media, namely air, water and soil. For humans, the main route of exposure of asbestos fibres is inhalation and, to a lesser extent, ingestion (HPA, 2007). Following inhalation, asbestos fibres are deposited on the epithelial surface of the respiratory tract. The fate of the asbestos fibres depends on the site of deposition and on their aerodynamic characteristics (HPA, 2007). Shorter, thicker fibres are usually deposited in the upper respiratory tract, whereas longer, thinner fibres may be carried deeper into the distal airways and alveolar regions (ASTDR, 2001). Amphibole fibres are retained for longer periods in the lung than chrysotile fibres (Albin et al. 1994; Churg 1994; Churg et al. 1993; Davis 1989).

7. During our discussions, an HSE official with expertise in asbestos analysis informed us that the usual procedure for the determination of airborne concentrations of respirable fibres in buildings involves filtering air through a membrane filter. After some manipulations of the filter, the fibres are counted using either an optical phase contrast microscope (PCM) or an electron microscope (EM). Both the scanning electron microscope (SEM) and the transmission electron microscope (TEM), if fitted with an analytical X-ray detector, can be used to verify that the fibre counted is asbestos. The TEM is also used in the non-occupational environment for asbestos analysis of small thin asbestos fibres and structures (see Annex A). Annex B provides further details on the methodologies used for asbestos measurement. The Control of Asbestos Regulations 2012 came into force on 6 April 2012. The control limit for asbestos is 0.1 asbestos fibres per cubic centimetre (or millilitre, ml) of air (0.1 f/cm^3; 0.1 f/ml). The control limit is not a 'safe' level and exposure from work activities involving asbestos must be reduced to as far below the control limit as possible (HSE website, 2013a).

Asbestos levels

8. A review by the Institute of Environmental Health (IEH) in 1997 indicated that background outdoor (ambient) levels of respirable asbestos fibres may range from 0.000001 to 0.0001 f/ml (IEH, 1997). In 1991, a report by the UK Department of the Environment (DoE) estimated a level of 0.0004 f/ml of regulated asbestos fibres in buildings which contain asbestos-containing products (ACPs) (DoE, 1991). Using data from a number of publications, the IEH considered most indoor air concentrations of asbestos were below 0.0002 f/ml. IEH also commented that a mean level of 0.0005 f/ml asbestos fibres was found inside buildings containing asbestos materials in good condition but the significance of this is difficult to interpret because no information on distribution of levels or median level was supplied (IEH, 1997).

9. Information provided by the DfE indicated that there were16,818 primary schools, 3,268 secondary schools and 2,420 independent schools in England (DfE, 2012a). It is estimated that more than 75% of schools in England have some buildings which contain asbestos (DfE, 2012b; http://www.education.gov.uk/schools/adminandfinance/schoolscapital/buildingsanddesign/managementofpremises/b00215518/asbestosmanagementschools/whatasbestosis). According to the report by IEH, "*in general, in school buildings constructed before 1946, exposure will be limited mainly to chrysotile lagging and asbestos cement roofing. Exposure in buildings constructed after 1946 will have been to a*

much broader range of materials including amphiboles in more "vulnerable" locations with a higher risk of damage and potential fibre release. Of the estimated 2,360 secondary schools built between 1945 and 1975, approximately 47% would have been "system built" rather than traditionally[2] built. In general, extensive use was made of sprayed coatings (amphiboles), Asbestolux ceiling panels and asbestos board (amosite) and asbestos cement partitioning in system-built buildings in the 1960s" (IEH, 1997).

10. We were provided with background information on indoor levels of asbestos in school buildings. The background paper is available on the COC website (http://www.iacoc.org.uk/papers/documents/CC-2011-13version2_000.pdf). There are data in the literature that result from a variety of analyses of asbestos levels in schools. Some analyses are continual measurements of normal (background) levels and presented in comparison with levels in areas where asbestos has been disturbed or damaged, some measurements were made during normal occupancy including following remediation or during/following routine maintenance, and other results were from re-enactment studies. The data presented suggest that schools not built with asbestos still contain low ambient background levels of asbestos of the same order of magnitude as indoor asbestos levels in other buildings. Although it is beyond the remit of this Committee to evaluate rigorously these diverse data on asbestos levels, it is clear that, if the school building contains asbestos products, there is increased potential for occupants, including children, to be exposed to asbestos. When asbestos is present and is disturbed or damaged, the data indicate that exposure can increase.

11. In addition to levels of asbestos in schools, we sought information on the asbestos levels found in residential dwellings, as children spend a large proportion of their time in their home environment. In 2010, there were approximately 22.4 million dwellings in England (EHS, 2012). The majority (80%) of dwellings are houses or bungalows while flats make up 20% of the stock. Traditionally built homes represent 95% of all homes built in the UK and 'non-traditional" construction methods (often referred to as 'system built') had been used for the remaining 5% of the stock. The ECHS (1993) indicated that the majority of system-built flats (73%) were built between 1945 and 1980 with ACPs such as lagging, board partitions and ceiling tiles. There may be other sources of asbestos in dwellings, such as ironing boards, gaskets in stoves and backing for vinyl flooring. The IEH report states that, as there is no evidence of fibre release from these products in buildings, exposure to asbestos in traditionally built houses can be considered to be part of ambient exposure to asbestos (IEH, 1997).

12. Few publications have specifically cited levels of asbestos in residential homes and flats, but there have been some reports from the UK and the US. We were provided with background information, which is available on the COC website (http://www.iacoc.org.uk/papers/documents/CC201201AsbestoslevelsinResidentialhomesandFlats.pdf). Overall, we conclude that, in general, the levels of asbestos found in traditionally built residential houses and flats are of the same order of magnitude as ambient indoor levels. There is potential for children to be exposed to increased levels of asbestos in their home environment in homes where ACPs were

[2] 'Traditionally' built is used to describe brick/block or rendered block/block cavity construction.

used in their construction. We note that airborne concentrations vary depending on the amount of activity in the area where ACPs were present, as evidenced by there being higher concentrations during the day when there is greater movement. We note the greater volume and dynamic flow of individuals in other buildings such as schools and the likelihood of higher disturbance of asbestos than in homes. We also note that uncontrolled releases of asbestos fibres due to DIY home maintenance and renovation are difficult to account for and could lead to increased exposure of children.

Asbestos-related diseases

13. Inhalation exposure to any type of asbestos is associated with diseases such as lung cancer, mesothelioma (cancer of the mesothelium, the protective lining that covers many of the internal organs of the body), asbestosis (a non-malignant scarring of the lung tissue) and non-malignant pleural disorders such as pleural plaques and diffuse pleural thickening (HSE, 2013b http://www.hse.gov.uk/statistics/causdis/asbestos.htm). The effects of asbestos exposure on an individual can be affected by factors such as 1) dose, 2) duration of exposure and time since exposure, 3) size, shape and chemical composition of the asbestos fibres and 4) individual risk factors such as smoking or pre-existing lung disease. Asbestos-associated respiratory diseases have long latency periods (the time period between first exposure to asbestos and disease onset). Most cases of non-malignant pleural disorders, lung cancer and asbestosis occur 15 or more years after initial exposure to asbestos (ASTDR, 2001) while the latent period between inhalation of asbestos and mesothelioma is seldom less than 15 years and may exceed 60 years (Bianchi et al., 1997).

14. A recent International Agency for Research on Cancer (IARC) evaluation of asbestos (2012) considered that there was sufficient evidence that all forms of asbestos (chrysotile, amosite, crocidolite, tremolite, actinolite and anthophyllite) are carcinogenic to humans (Group 1) and that it causes mesothelioma and cancer of the lung, larynx and ovary. IARC also considered that there is evidence (in some cases limited) in humans for positive associations between exposure to asbestos and cancer of the pharynx, stomach and colorectum.

15. In the context of advising on the relative vulnerability of children to asbestos, we concentrated on the risk of mesothelioma rather than other cancer endpoints as mesothelioma is nearly always associated with asbestos exposure and hence is less likely to be confounded by other factors. The lung cancer risk caused by childhood asbestos exposure is lower than the mesothelioma risk (HEI, 1991), and the risk for other cancers is much lower still. There is a synergistic interaction between smoking and asbestos exposure for lung cancer risk, but not for mesothelioma. Mesothelioma can develop in the tissues covering the lungs or the abdomen. Most cases of mesothelioma (~ 75%) occur in the chest, with a lesser proportion (~25%) occurring in the abdomen (Cancer Research UK, 2012).

16. Mesothelioma is the 20th most common cancer in the UK (2009), accounting for less than 1% of all cancers. In men, it is the 17th most common cancer in the UK, accounting for over 1% of all new cases of cancer. In the UK in 2010, 2,543 people were diagnosed with mesothelioma (Cancer Research UK, 2012). The overall

incidence rate in the UK is 2.8 cases in 100,000 people (2.8/100,000). Mesothelioma is five times more common in men than in women, with incidence rates of 5.3/100,000 in men and 0.9/100,000 in women. Around 9 out of 10 mesothelioma cases occur in people aged 60 and over. Mesothelioma incidence rates have increased almost four-fold since the early 1980s. The incidence of mesothelioma is still increasing and is expected to peak circa 2016 and to decline rapidly thereafter. The lifetime risk of developing mesothelioma in the UK is estimated to be 1 in 150 for men and 1 in 773 for women (calculated using 2006-2008 data) (Cancer Research Statistical Team, 2011). The potential causes of mesothelioma relevant to Great Britain have been summarised in a report by the HSE and are provided in Table 1 (HSE, 2007).

17. There is a consistent increase in risk of mesothelioma with increasing exposure to asbestos. This has been reported in cohort studies as well as in analyses of asbestos fibres in the lungs (Hansen et al, 1998; Churg et al., 1993, McDonald et al., 1989 and Roggli et al., 1986). The dose-response is thought to be approximately linear for pleural mesothelioma (Hodgson and Darnton 2000). The sub-linear relationship seen in some cohort studies may be a statistical effect of inaccuracies in exposure assessment. Studies have suggested that the amphibole forms of asbestos may be more potent than chrysotile, particularly for mesothelioma risk, because of the apparent longer retention of amphibole fibres in lung tissue (ASTDR, 2001; Mossman et al. 1990). Hodgson and Darnton (2000) analysed exposure-response relationships for mesothelioma mortality in studies of 17 asbestos-exposed occupational cohorts and concluded that relative potencies ("exposure specific risk of mesothelioma") are in a ratio of 1:100:500 for chrysotile, amosite, and crocidolite, respectively. We agree with Hodgson and Darnton (2000) that there is no evidence of any threshold for mesothelioma risk. This view was reflected in the statement on low level exposure to asbestos from the UK HSE WATCH committee, published in 2011, which stated that "*there are risks of asbestos-induced cancer arising from work-related cumulative exposures below 0.1 fibres/ml.years. The risk will be lower, the lower the exposure, but "safe" thresholds are not identifiable. Where potential exposures to amphiboles, particularly crocidolite, are below 0.1 fibres/ml.years (for example, 0.01 fibres/ml.years), the available scientific evidence suggests no basis for complacency, but rather a basis for active risk management*".

Epidemiological and case reports on the effect of asbestos exposure in childhood and the development of mesothelioma in later life

18. We reviewed the available case reports of mesothelioma in children with caution, due to the possibility of misdiagnosis. Few epidemiological studies have investigated exposure to asbestos in childhood and the risk of mesothelioma in later life. Most of the information available is in the form of case reports. We were provided with a review of available studies, attached as Annex C, and this review included studies where exposure to asbestos occurred either through para-occupational exposure, domestic exposure or environmental exposure. A recent study by Reid et al. (2013) examined the cancer incidence and all-cause mortality of people exposed to crocidolite as children in the town of Wittenoom, Western Australia. In the study, individual asbestos exposures were estimated by assigning all residents an intensity of exposure of 1.0 f/ml of air between 1943 – 1957 (time period when new mill was in commission) and an intensity of exposure of 0.5 f/ml between 1958 -1966 (time

period when the milling operation had ceased). Interpolation between the dust surveys that used personal monitors allocated exposures from 0.5 f/ml in 1966 to 0.01 f/ml in 1992. We note that these exposure values are several orders of magnitude higher than the levels typically reported in school buildings and residential homes with asbestos in good condition in the UK. We agreed that the exposure assessment was fairly crude and probably underestimated exposure for some residents. The study reported an overall increase in all-cause mortality and cancer incidence rates in adults that grew up as children in Wittenoom compared with the Western Australian adult population. The increase was predominantly but not solely due to malignant mesothelioma. There was a statistically significant increased incidence of mesothelioma. There were also consistently increased rates of some other cancers namely ovarian and brain cancers in females and leukaemia, prostate, brain, and colorectal cancers in males. We note two earlier studies (Hansen et al. (1998) and Reid et al. (2007)), involving the same cohort of former residents of Wittenoom, Western Australia. In both studies, individual asbestos exposures were estimated using the method described above. Hansen et al. (1998) found no significant association between incidence of mesothelioma up to the end of 1993 and age of first exposure to crocidolite in these subjects, who had no history of occupational exposure to asbestos. Reid et al. (2007) presented evidence that children < 15 years of age at first exposure had lower rates of mortality with mesothelioma compared to those ≥ 15 years at first exposure, but this could reflect age-related differences in environmental exposure. Although the study indicates that the lifetime risk of mesothelioma is lower in children with a young age at first exposure, compared with older children, we do not consider it appropriate to draw conclusions from this one study. Overall, we consider there is evidence that childhood exposure to asbestos can cause mesothelioma but the epidemiological data are too limited to assess differential susceptibility between children and adults.

Effect of children's age and life expectancy on mesothelioma risk

19. We discussed the trends in the national mesothelioma mortality rates and other epidemiological data. It was notable that the death rate from mesothelioma at 85 years of age is ten times higher than at 55 years. Among British men, the rate for those born in 1945 is much higher than that for those born in 1955, but the mortality rates in women are not declining much even in the population born in 1960, a cohort born at the peak of asbestos use. It is possible that this is because the majority of mesotheliomas in females are the result of environmental or para-occupational exposure to asbestos (Table 1) which may have occurred before the age of 20 and possibly before the age of 10. It is acknowledged that the lifetime mesothelioma risk following asbestos exposure at any age would be increased as life expectancy increased, and this should be allowed for. However, the effect could not be predicted reliably, particularly for childhood exposure, due to uncertainties about future changes in overall mortality rates and the rate of increase in the mesothelioma incidence rate beyond 60 years after first exposure.

20. In terms of lifetime risk of developing mesothelioma, it is well recognised that the younger a person is when they are exposed, the greater the risk of developing mesothelioma, which reflects the latency of the disease as younger people are more likely to live long enough for the disease to manifest itself. The effect of age of exposure on the risk could be large, as risk increases to the third or fourth power of

time after first exposure (Peto et al., 1982). Because of differences in life expectancy, for a given dose of asbestos the lifetime risk of developing mesothelioma following exposure to asbestos is predicted to be about 3.5 times greater for a child first exposed at age 5 compared to an adult first exposed at age 25 and about 5 times greater when compared to an adult first exposed at age 30 (Darnton, 2013, personal communication to the Committee and available on the COC website, http://www.iacoc.org.uk/papers/documents/CC20132EffectofAgeonMesotheliomaRisk-AnnexA.pdf). This value is broadly consistent with that derived using the life-table approach in an unpublished report presented to the Committee by Howie (2012). It is also in line with the value calculated by the HEI (1991) where, based on life expectancy, the lifetime risk of developing mesothelioma following 10 years' exposure is expected to be about 5 times greater for a child first exposed at age 5 than for an adult first exposed at age 30.

Animal Studies

21. As part of our strategy, we considered whether animal studies which compare the changes and consequences following juvenile exposure to asbestos with those following exposure in adult life may be informative. Only one such study, which specifically addressed the effect of age at exposure to asbestos on the occurrence of mesothelioma in rats, was found. Berry and Wagner (1976) injected Wistar rats of both sexes with crocidolite asbestos intrapleurally at either 2 months or 10 months of age and found by observation and by statistical analysis a higher rate of mesothelioma in the latter group, compared to the former group after exclusion of mortality due to other causes.

22. Overall, the animal study provided data on age related susceptibility to asbestos in rodents. We noted that the rodent data do not support the hypothesis that exposure at a younger age increases susceptibility to mesothelioma due to asbestos exposure. Consideration was given by members to the methodologies used in the study, their impact on the results and the relevance of the study to humans in particular children. Issues raised included route of exposure used (intrapleural injection), and differences in physiology and maturation processes between young rats and children. Although the Committee does not dismiss animal data as an experimental pathology approach to understanding human disease processes, we agreed that this study did not offer any significant insight into the relative vulnerability of children compared to adults to asbestos. The Committee considered that further animal studies would probably not be helpful in view of the difficulties involved in conducting valid studies and the scarce availability of facilities in which to conduct such studies in juvenile animals.

Comparative differences in respiratory physiology, inflammatory response and dosimetry between children and adults

23. An understanding of the physiological differences between adults and children in the respiratory and immune systems, and the issue of inhalation dosimetry would play a key part in addressing the relative vulnerability of children to asbestos compared to adults. We thus sought the advice of Professor Andy Bush (Professor

of Paediatric Respirology at Imperial College & Consultant Paediatric Chest Physician, Royal Brompton & Harefield NHS Foundation Trust), an expert in juvenile respiratory physiology, on the behaviour of asbestos in a child's respiratory tract and whether this might make them more or less susceptible.

24. The structure and physiology of the lung differ significantly between adults and children although it is not clear how this impacts on the uptake and disposition of any inhaled fibres. While it is not possible to be definitive, we were advised that the lungs could be considered to reach the adult stage around the mid-teenage (post pubescent) years. It was noted that foetal lung development occurs as zonal growth with all the airway branches being determined by the 16th week of pregnancy. The number and size of alveoli increase with age. Therefore, in a child there would be a lower surface area for gaseous exchange. We suspect that deposition of asbestos fibres could be different from that in adults given the differences in airway dimension and structure. However, we are not aware of any studies specifically assessing this in relation to fibres. Similarly, we are not aware of any study which demonstrates differences between the transit of asbestos fibres through the pleura to the site of carcinogenic action in a juvenile compared to an adult. During our discussions we were informed that the juvenile lung was particularly susceptible to injury and any lung damage received in the first 4 years of life, in terms of air flow obstruction, would remain for life. This could manifest later in life as increased susceptibility to some smoking-related disorders and conditions such as chronic obstructive pulmonary disease (COPD), although it is not known whether this would have an effect on life-time lung cancer risk.

25. While the lung is the primary target organ for asbestos toxicity, a number of clinical and experimental studies have shown that the immune system may also be altered by exposure to asbestos at occupationally relevant concentrations (Rosenthal et al., 1998). Reported immunological effects include the influence of asbestos exposure on non-specific immunity (natural killer cells, epithelial cells and lung macrophages), on specific immunity and asbestos-induced pathophysiologic responses associated with generation of various reactive oxygen species (ROS). We are unclear how the development of the immune system in childhood would impact on these reported immunological responses to asbestos. It was noted that immunologic responses associated with antibody production are very different from birth until 2 years of age from those in the adult.

26. In terms of the susceptibility of children, we reviewed the International Commission on Radiological Protection (ICPR) modelling framework for particle dosimetry and the US EPA inhalation dosimetry methods for application to children for risk assessment. In 2005, the US EPA described how risk assessment in childhood can be assessed as a sequence of life stages. As an infant develops into a child and a child into an adult, there may be periods of time in their development where they are more susceptible and have enhanced sensitivity to environmental agents. We recognise that changes in behaviour and physiology as a child ages can increase a child's exposure to chemicals and dose of chemicals. Toxicokinetic differences between children and adults can cause children to have increased

uptake and reduced clearance of certain chemicals from their bodies. Inhalation dosimetry can differ across age groups as children's breathing rate is greater than adults' per kilogram body weight and per respiratory tract surface area (in particular in the pulmonary region).

27. In our discussion on lung dosimetry we considered that surface area or lung surface area might be the most appropriate metric for converting the dose/body weight from an adult to a child. We noted that the deposition of inhaled fibres could be different in children compared to adults due to their narrower airways and also due to the lower volume of air inhaled by children each day, resulting in fewer fibres being inhaled in a given situation. We discussed the potential for dilution of the fibres deposited as a child grows which would, therefore, reduce the body burden. We emphasise that it cannot be assumed that deposition would be the same at age 2 compared to age 18, however we are not clear whether there would be greater or less deposition.

28. An invited expert, Professor Jonathan Grigg (Professor of Paediatric Respiratory and Environmental Medicine at Barts and the London School of Medicine, Queen Mary University of London, and a consultant paediatrician at the Royal London Hospital (Whitechapel, London)) provided an insight on whether it is possible to extrapolate information on the effects of particulates in the juvenile lung to fibres. Modelling data generated specifically for the Committee's assessment were discussed. The calculations took into account the fact that children have higher metabolic rates and faster breathing rates than adults which, it was noted, initially suggests greater exposure in children compared to adults. This is the basis of the general assumption that children are exposed to double the dose of a substance compared to adults on the basis of lung surface area. Children also have shallower breathing, which interacts with the faster rate in a complex way to alter where fibres and particles are deposited in the lung, with less deposition in the lower airways. In the modelling, the geometry of the airways was scaled down by approximately a third for children; clearance mechanisms are more effective as there is less distance for inhaled particulates/fibres to travel to be removed. Therefore, the underlying assumption that children will inhale more fibres does not hold. The Committee considered that, for the same dose, this modelling provided evidence that children would not be more sensitive to fibres than adults.

<u>Uncertainties and data gaps</u>

29. We acknowledge a number of uncertainties and data gaps in our assessment of the relative vulnerability of children to asbestos. One such uncertainty relates to exposure assessment. The levels of asbestos at various sites reported in many references are uncertain given the problems in measurement, suitability of the analytical method used, and comparability of results. In many cases, the exposure measurements are largely historical and it would be valuable to have more contemporary measurements, especially from schools in the UK.

30. From an epidemiological perspective, few studies have specifically investigated the effect of childhood exposure to asbestos and the risk of developing mesothelioma in later life. We note that the levels of asbestos exposure tended to be

very high in these studies and not comparable to the UK situation. We also note uncertainties in interpreting data from many of the epidemiology studies. Issues include the accuracy of exposure measurements or estimates of uncertainty in such measurements; unknown accuracy of cancer diagnosis; limited cohort size and loss to follow up; and inadequate statistical analysis in some studies.

31. We also acknowledge uncertainties in the risk estimation. Issues include the extrapolation of data from adult age-related cancers to children and the assumption that the risk model from first exposure as a function of age, which was derived from occupational studies in adults, is the same for a child as for an adult. From our discussion on the intrinsic susceptibility of children compared to adults, we identify one key data gap, namely the behaviour of fibres in children's respiratory tracts compared to those of adults.

<u>Conclusions</u>

32. Following our deliberations, we make the following conclusions:

a) Asbestos is classified by IARC as a group 1 carcinogen, i.e. it is carcinogenic to humans. Asbestos causes mesothelioma, and cancer of the lung, larynx, and ovary. In their recent evaluation, IARC also considered that there is evidence (in some cases limited) in humans for positive associations between exposure to asbestos and cancer of the pharynx, stomach and colorectum.

b) In general terms, the levels of respirable asbestos fibres in air range from lowest to highest in the following order:

- background outdoor ambient levels (lowest levels)
- background indoor ambient levels in buildings not built with asbestos
- levels in buildings built with asbestos where the asbestos is in good condition
- levels in buildings built with asbestos where the asbestos has been disturbed or damaged and/or is in bad condition (highest levels)

c) The data in general suggest that the levels of asbestos found in schools with no asbestos in their construction are of the same order of magnitude as indoor asbestos levels in other buildings. When asbestos is present and is disturbed or damaged, the data indicate that exposure to asbestos fibres can increase. However, the information on levels found in schools is largely historical and there is a lack of contemporary data on asbestos in schools. In view of the importance of this issue, there would be a benefit in generating new exposure data.

d) There is also potential for children to be exposed to asbestos in their home environment in homes where asbestos-containing products (ACPs) were used in their construction. In general, the reported levels of asbestos found in traditionally built houses and flats are of the same order of magnitude as ambient indoor levels. However, activities such as maintenance can disturb asbestos and increase exposure both at home and at school.

e) From an epidemiological perspective, there is good evidence that childhood exposure to asbestos can cause mesothelioma in later life. However, the

epidemiological data are too limited to assess differential susceptibility between children and adults. We recognise the effect of increased life expectancy of children compared to adults and the increased likelihood of mesothelioma as a result of the long latency period for this cancer. Because of differences in life expectancy, for a given dose of asbestos, the lifetime risk of developing mesothelioma is predicted to be about 3.5 times greater for a child first exposed to asbestos at age 5 compared to an adult first exposed at age 25 and about 5 times greater when compared to an adult first exposed at age 30.

f) There are respiratory and immunological differences between adults and children but their impact on the susceptibility of children to asbestos-induced cancer is unclear. We were informed that the juvenile lung is particularly susceptible to injury and that any lung damage received in the first 4 years of life, in terms of air flow obstruction, would remain for life. However, it is not possible to determine what effect fibre inhalation before the age of 5 would have on lung function, and whether any effect would persist. Some physiological differences (e.g. respiratory rates, total volume, and airway dimension) have the potential to modify the susceptibility of children compared to adults to asbestos. However, modelling of fibre deposition in children has indicated that children are unlikely to inhale more fibres than adults.

g) While the available relevant animal study provides data on age-related susceptibility to asbestos in rodents, it does not offer any significant insight into the relative vulnerability of children compared to adults to asbestos.

h) From the available data, it is not possible to say that children are intrinsically more susceptible to asbestos-related injury. However, it is well recognised by this Committee that, due to the increased life expectancy of children compared to adults, there is an increased lifetime risk of mesothelioma as a result of the long latency period of the disease. In reaching our conclusion and taking into consideration that there are a number of uncertainties and data gaps, we conclude that exposure of children to asbestos is likely to render them more vulnerable to developing mesothelioma than exposure of adults to an equivalent asbestos dose.

COC May 2013

References:

Albin M, Pooley FD, Strömberg U, Attewell R, Mitha R, Johansson L, Welinder H. (1994). Retention patterns of asbestos fibres in lung tissue among asbestos cement workers. Occup. Environ. Med. 51:205-211.

Asbestos Information Centre UK website, accessed January 2013. http://www.aic.org.uk/Asbestos_imports.htm

ASTDR (2001) http://www.atsdr.cdc.gov/toxprofiles/tp61.pdf

Berry G. & Wagner C. (1976) Effect of age at inoculation of asbestos on occurrence of mesothelioma in rats. Int. J. Cancer, 17:477-483.

Bianchi C, Giarelli L, Grandi G, Brollo A, Ramani L, Zuch C. (1997). Latency periods in asbestos-related mesothelioma of the pleura. Eur. J. Cancer Prev. 6:162-166.

Cancer Research UK. (2012) http://www.cancerresearchuk.org/cancer-info/cancerstats/types/Mesothelioma/incidence/

Cancer Research UK Statistical Information Team. (2011). Statistics on the risk of developing cancer, by cancer type and age. Calculated using 2006-2008 data for the UK using the 'Adjusted for Multiple Primaries (AMP)' method (Sasieni PD, Shelton J, Ormiston-Smith N, Thomson CS, Silcocks PB. What is the lifetime risk of developing cancer?: The effect of adjusting for multiple primaries Br J Cancer 2011. 105(3): 460-65. http://info.cancerresearchuk.org/cancerstats/incidence/risk/

Control of Asbestos at Work Regulations UK (CAWR, 2012). http://www.legislation.gov.uk/uksi/2012/632/pdfs/uksi_20120632_en.pdf

Churg A, Wright JL, Vedal S. (1993) Fiber burden and patterns of asbestos-related disease in chrysotile miners and millers. Am. Rev. Respir. Dis. 148:25–31.

Churg A. (1994). Deposition and clearance of chrysotile asbestos. Ann. Occup. Hyg. 38:625-633.

Davis JMG. (1989). Mineral fibre carcinogenesis: Experimental data relating to the importance of fibre type, size, deposition, dissolution and migration. IARC Sci. Publ. 90:33-45.

DfE (2012a). https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/167509/sfr10-2012.pdf.pdf

DfE (2012b). http://www.education.gov.uk/schools/adminandfinance/schoolscapital/buildingsanddesign/managementofpremises/b00215518/asbestosmanagementschools/whatasbestosis

DoE (1991) Department of the Environment. Asbestos materials in buildings. London UK, HMSO, 3rd Edition.

EHS (2012). English Housing Survey: HOMES. Annual report on England's housing stock, 2010 http://www.communities.gov.uk/documents/statistics/pdf/2173483.pdf

ECHS (1993). English House Condition Survey 1991 London UK, HMSO.

Hansen J, de Klerk NH, Musk AW, Hobbs MS. (1998). Environmental exposure to crocidolite and mesothelioma: Exposure-response relationships. Am. J. Respir. Crit. Care Med. 157:69-75.

HEI-AR. (1991) Asbestos in Public and Commercial Buildings A Literature Review and Synthesis of Current Knowledge, Health Effects Institute - Asbestos Research 1991-01-01 (Report commissioned by U.S. Congress). Cambridge MA.

Hines RN, Sargent D, Autrup H, Birnbaum LS, Brent RL, Doerrer NG, Cohen Hubal EA, Juberg DR, Laurent C, Luebke R, Olejniczak K, Portier CJ, Slikker W. (2010). Approaches for assessing risks to sensitive populations: lessons learned from evaluating risks in the pediatric population. Toxicol. Sci. 113(1):4-26.

Hodgson JT, Darnton A. (2000). The quantitative risks of mesothelioma and lung cancer in relation to asbestos exposure. Ann. Occup. Hyg. 44(8):565-601.

Howie, R. (2012) Effect Of Children's Age And Life Expectation On Mesothelioma Report from Risk Robin Howie Associates, Edinburgh submitted to COC by Mr Michael Lees in July 2012, non peer reviewed.

HPA (2007). Asbestos.
http://www.hpa.org.uk/webc/HPAwebFile/HPAweb_C/1202487029721

HPA (2007) http://www.hpa.org.uk/webc/HPAwebFile/HPAweb_C/1204013002817.
The Public Health Significance of Asbestos Exposures from Large Scale Fires.
Saunders and Smith.

HSE (2007). The burden of occupational cancer in Great Britain. Technical Annex 4: RR595: Meothelioma. http://www.hse.gov.uk/research/rrpdf/rr595ann4.pdf

HSE (2012). http://www.hse.gov.uk/contact/faqs/asbestos-health-risks.htm

HSE (2013a) http://www.hse.gov.uk/asbestos/regulations.htm

HSE (2013b) http://www.hse.gov.uk/contact/faqs/asbestos-health-risks.htm

International Agency for the Research on Cancer (IARC) (2012). Asbestos (Actinolite,amosite, anthophyllite, chrysolite, crocidolite, tremolite).

IEH (1997). Institute for Environment and Health, Medical Research Council. Fibrous materials in the environment.

McDonald JC, Armstrong B, Case B, Doell D, McCaughey WT, McDonald AD, Sébastien P. (1989). Mesothelioma and asbestos fiber type. Evidence from lung tissue analyses. Cancer, 63:1544–7.

Mossman BT, Bignon J, Corn M, Seaton A, Gee JB. (1990). Asbestos: Scientific developments and implications for public policy. Science 247:294-301.

Peto J, Seidman H, Selikoff, IJ. (1982). Mesothelioma mortality in asbestos workers: implications for models of carcinogenesis and risk assessment. Br. J. Cancer; 45(1):124–135.

Rosenthal GJ, Corsini E, Simeonova P. (1998) Selected new developments in asbestos immunotoxicity. Environ. Health. Perspect. 106(suppl 1):159-69.

Reid A, Berry G, de Klerk N, Hansen J, Heyworth J, Ambrosini G, Fritschi L, Olsen N, Merler E, Musk AW. (2007). Age and sex differences in malignant mesothelioma after residential exposure to blue asbestos (crocidolite). Chest, 131(2):376-82

Reid A, Franklin P, Olsen N, Sleith J, Samuel L, Aboagye-Sarfo P, de Klerk N, Musk AW. (2013). All-cause mortality and cancer incidence among adults exposed to blue asbestos during childhood. Am. J. Ind. Med., 56(2):133-45.

Roggli VL, Pratt PC, Brody AR. (1986). Asbestos content of lung tissue in asbestos related diseases: a study of 110 cases. Br. J. Ind. Med., 43:18–28.

(WATCH, 2011). (http://www.hse.gov.uk/aboutus/meetings/iacs/acts/watch/240211/asbestos-final-position-statement.pdf).

Table 1: Potential causes of mesothelioma relevant to Great Britain*

Group	Attributable cause
1.	**Occupational asbestos exposures** Exposure during work activities – either due to an individual's own work, or due to the work of others in the same workplace.
2.	**Paraoccupational and environmental exposures** Exposure outside work activities but resulting from the work activities of others, for example, laundering overalls used by asbestos workers Living close to industrial sites using or producing asbestos / asbestos products Living or working in buildings containing asbestos in poor condition DIY activities involving work with asbestos
3.	**Background cases (cases that would have occurred in the absence of any industrial exploitation of asbestos)** Spontaneous cases occurring in the absence of any exposure Environmental exposures via naturally occurring asbestos or other mineral deposits (such exposures are unlikely to occur in Great Britain)

***Table obtained from HSE (2007)**

Appendix A. Experts, Advisors and other individuals who provided information on this item to the COC

Those whom attended the COC meetings and/or provided written information

Professor Andy Bush[3] MB BS(Hons) MA MD FRCP FRCPCH
Mr Brendan Beckett (DfE)
Dr Garry Burdett (HSL)
Mr Andy Darnton (HSE)
Professor Jonathan Grigg BSc MB BS MD MRCP FRCPCH
Mr Michael Lees (Asbestos in Schools Group)
Ms Julie Winn (Chair of the Joint Union Asbestos Committee)
Mr Robin Howie (Robin Howie and Associates)

[3] By teleconference link

ANNEX A to Asbestos Statement CC/13/S1

ISO definitions of different fibres/asbestos types (ISO 13794:1999)

asbestos structure	term applied to an individual asbestos fibre, or any connected or overlapping grouping of asbestos fibres or bundles, with or without other particles
fibril	single fibre of asbestos which cannot be further separated longitudinally into smaller components without losing its fibrous properties or appearances
fibre	elongated particle which has parallel or stepped sides. For the purposes of this International Standard, a fibre is defined to have an aspect ratio equal to or greater than 5:1 and a minimum length of 0.5 μm.
fibre bundle	Structure composed of parallel, smaller-diameter fibres attached along their lengths. A fibre bundle may exhibit diverging fibres at one or both ends.
fibrous structure	fibre, or connected grouping of fibres, with or without other particles
PCM-equivalent fibre	fibre of aspect ratio greater than or equal to 3:1, longer than 5 μm, and which has a diameter between 0.2 μm and 3.0 μm. For the purposes of this International Standard, PCM is the abbreviated term for phase-contrast optical microscopy.
PCM-equivalent structure	fibrous structure of aspect ratio greater than or equal to 3:1, longer than 5 μm, and which has a diameter between 0,2 μm and 3,0 μm
primary structure	fibrous structure that is a separate entity in the TEM image
structure	single fibre, fibre bundle, cluster or matrix
twinning	occurrence of crystals of the same species joined together at a particular mutual orientation, and such that the relative orientations are related by a definite law
unopened fibre	large diameter asbestos fibre bundle which has not been separated into its constituent fibrils or fibres

ANNEX B to Asbestos Statement CC/13/S1

ANNEX B – Measurements of asbestos

	Description	Measurements
PCM analysis		Countable fibres are defined as particles with length >5µm, width <3µm and aspect ratio (length: width ratio) >3:1. Fibres having widths <0.2µm may not be visible using this method. The PCM count represents only a proportion of the total number of fibres present. PCM does not determine whether fibres are asbestos or not. Therefore the count is only an index of the numerical concentration of fibres and not an absolute measure of the number of fibres present
PCM equivalent fibres (PCME):		these are a sub set of the > 5 µm long fibres that would be expected to be counted by the WHO PCM method and counts those fibres with a minimum width of 0.2 µm and a maximum width of 3 µm.
TEM analysis:	TEM is the "gold standard" and a range of measurements can be used. In practice a combination of energy dispersive x-ray analysis and selective area electron diffraction is used to identify the asbestos type for any size of fibre. Energy dispersive x-ray analysis can be made quantitatively in terms of % weight of each element and electron diffraction can measure the d-spacing and angles of the atomic structure to meet the highest standards for defining minerals.	All > 5 µm long fibres: particles with an aspect ratio of >3:1 which has parallel or stepped sides.

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	Description	Measurements
All fibres:		All >0. 5 μm long particles with an aspect ratio of >3:1 which has parallel or stepped sides. In practice the 3:1 and 5:1 aspect ratios make only a minor difference to asbestos fibres but 3:1 is used for optical microscopy and epidemiology exposures
SEM analysis	SEM in its normal form is much more limited than TEM for identification and has only energy dispersive x-ray analysis to "classify" the fibre type. It cannot fully identify the fibre as the TEM can. The sample is mounted on a filter and stub "thick sample" so there are many more problems and limitations to the energy dispersive x-ray analysis than the TEM which uses a "thin sample." Often only fibres of width of >0.25 μm can be classified based on the ratio of peak heights. High resolution field emission SEM's are now more common but have not been used for asbestos measurements reported in the data reviewed by the CoC. High resolution field emission SEM have the same limitations as tungsten SEMs except smaller fibre widths could be classified.	These are similar to PCM equivalent fibres but have lower visibility and may use a slightly high minimum width 0.25 μm. Some early methods counted fibre >2.5 μm long as well.

Annex C to Asbestos Statement CC/13/S1

COMMITTEE ON CARCINOGENICITY OF CHEMICALS IN FOOD, CONSUMER PRODUCTS AND THE ENVIRONMENT

Relative Vulnerability of Children to Asbestos compared to Adults – Epidemiology and Case Reports on asbestos exposure in childhood and the risk of mesothelioma in later life.

1. There is little information concerning mesothelioma of childhood, limited mainly to individual case reports (Fraire et al., 1988). Mesothelioma is rarely diagnosed in children as the disease has a long latency period and typically associated with occupational exposure to asbestos. However, few publications (case reports and epidemiological studies) have addressed the issue of exposure to asbestos in childhood and the risk of mesothelioma in later life. In these studies detailed below, exposure to asbestos occurred either through para-occupational exposure, domestic exposure or environmental exposure.

2. Grundy and Miller (1972) identified 13 cases of mesothelioma in children from 42,597 death certificates for all children less than 15 years of age who died of cancer in the US from 1960-1964 and for those under 20 years of age from 1965-1968. Using a population based approach; Cooper et al. (1989) identified cases of childhood mesothelioma in Texas and the US. They identified 6 cases in total of childhood mesothelioma, 2 from 1969 to 1971 from the National Cancer Institute and 4 cases from 1973 to 1984 from Surveillance, Epidemiology and End-Results Program (SEER). Using the SEER population at risk from 1973 to 1984, Copper et al. estimated that the average annual incidence rate in children, aged 0-19 years was 0.5 cases per 10 million population (95% CI 0.0 – 1.0 per 10 million). In the UK, Muir et al. (1992) and Niggli et al. (1994) found only 4 cases of peritoneal mesothelioma among 918 malignancies registered by the West Midlands Regional Research Group in the UK in the time period 1987 to 1994. The calculated annual incidence of mesothelioma was approx 0.6 cases per million children younger than 15 years. In an IARC publication in 1980, Wasserman and Wasserman (1980) reviewed the literature from the late 1970s and presented the available data on childhood mesothelioma. The biggest difference that they could identify between the characteristics of mesothelioma between adults and children was the latency period. They found that the latency of the tumour was up to 14 years in children but ranged from 25-55 years in adults. They did not include any comment on the causes of the childhood mesotheliomas.

Epidemiological Studies

3. Metintas et al. (1999) reported prospective epidemiological data of diffuse malignant pleural mesothelioma (DMPM) diagnosed in their clinic in Eskisehir in central Turkey from 1989-1997. The use of "white soil" (containing tremolite

asbestos) was common in this area as whitewash or plaster material for the walls, for insulating and water proofing floors and roofs of houses. Of the 113 DMPM patients, 59 were men and 54 were women. They found that 97 patients (86%) had non occupational asbestos exposure. 28 of the patients had lived in the villages their entire lives and thus formed the 'continuous exposure' group. The other 69 patients had been born in the village but migrated to a city or gave up "white soil" usage for various reasons and they formed the partial exposure group. The mean length of exposure was 55 years for the continuous exposure group and 25 years for the partial exposure group. The mean age of disease appearance was 56 years (range 26-81 years) and there was no significant difference between age at appearance of disease between the two groups. As patients had been exposed to asbestos from birth, the latency period was equivalent to the age of the patients. Mentintas et al. (2002) conducted a field based epidemiological study to determine the mesothelioma rate in an Eshisehir cohort with environmental exposure to asbestos from birth through the use of white soil in the area. They reported that the annual mesothelioma incidence rate was 114.8/100,000 for men and 159.8/100,000 for women. These data indicate that the risk of mesothelioma is 88.3 and 799 times greater in men and women, respectively compared to the world background incidence rates of 1.3/100,000 for men and 0.3/100,000 for women.

4. Luce et al. (2000) performed a case-control study on a population in New Caledonia where a high incidence of malignant pleural mesotheliomas (MPM) have been observed. Only data relevant to MPM are presented here. They found that in the high mesothelioma incidence area, a very friable rock from local outcropping has been used by residents as a whitewash for indoor and outdoor walls of houses. Sampling of the whitewash found it to consist of virtually pure tremolite asbestos. The authors found the risk of pleural mesothelioma was strongly associated with exposure to whitewash with 14/15 patients reporting exposure. They found that 13/14 cases were exposed since birth with no case of exposure starting after 16 years of age. The risk of mesothelioma increased with the duration of exposure. Exposure for < 20 years gave an Odds ratio (OR) = 22.2 (95 % CI 2.33-211)) and exposure for ≥ 20 years gave an OR of 65.1 (95% CI 7.69 – 551).

5. Libby is a small community located in North Western Montana close to the Zonolite Mountain containing high concentrations of vermiculite ore. The vermiculite ore contains amphibole asbestos composed of 6% tremolite, 84 % winchite and 11 % richterite. The ore was mined from 1920s until the closure of the mine in 1990. A case report by Whitehouse et al. (2008) describes 11 cases of mesothelioma from non occupationally exposed individuals. From the study exposure and pathology data, a number of cases were exposed to asbestos in childhood, either through the presence of the asbestos in the gardens, in their homes or through paraoccupational exposure. In one case, a 65 year old male diagnosed with mesothelioma had lived in Libby from birth to 18 years of age. His father had worked at the mine throughout the 18 years and he was paraoccupationally exposed to vermiculite through him. He was also exposed to the vermiculite from its use in their garden and in their attic of his childhood home. Whitehouse et al. (2008) describes another case of

mesothelioma in a 45 year-old female who lived 100 miles from Libby. Her father worked at the mine when she was 14 years old. During the time that her father worked at the mine, the patient would launder his clothes at the weekend. In another case, a 48 year-old female died of mesothelioma in 1998 diagnosed 2 years earlier. It was reported that she lived from birth in Libby and her home was near contaminated ball fields and railroad tracks. She also played on piles of vermiculite ore as a child.

6. Crocidolite (blue) asbestos was mined and milled at Wittenoom Gorge, Western Australian from 1943 to 1966. A recent study by Reid et al. (2013) examined the cancer incidence and all-cause mortality of people exposed to crocidolite as children in the town of Wittenoom, Western Australia. In the study, individual asbestos exposures were estimated by assigning all residents an intensity of exposure of 1.0 f/mL of air between 1943 – 1957 (time period when new mill was in commission) and an intensity of exposure of 0.5 f/mL between 1958 -1966 (time period when the milling operation had ceased). Interpolation between the dust surveys that used personal monitors allocated exposures from 0.5 f/ml in 1966 to 0.01 f/ml in 1992. The study reported an overall increase in all-cause mortality and cancer incidence rates in adults that grew up as children in Wittenoom compared with the Western Australian adult population, predominantly but not solely due to malignant mesothelioma. There was a statistically significant increased incidence of mesothelioma. There were also consistently increased rates of some other cancers namely ovarian and brain cancers in females and leukaemia, prostate, brain, and colorectal cancers in males but whether these increases were significant or not depended on the method analysis used.

7. Two other studies (Hansen et al. (1998) and Reid et al. (2007), involving the same cohort of former residents of Wittenoom in Western Australia investigated the effect of childhood exposure to crocidolite. In both studies, individual asbestos exposures were estimated using the method as described in Reid et al. (2013). Reid et al. (2007) reported on the malignant mesothelioma that occurred in residents of the town who did not work at the mill or mine and tried to determine if children were more susceptible to asbestos exposure than adults. Most residents moved to the town during the 1950s and 1960s, with 10% of residents born in Wittenoom and 42 % of residents were < 15 years when they first resided there. The authors reported that there was evidence that children < 15 years of age had lower rates of mortality with mesothelioma than those ≥ 15 years at first exposure, with a 40 % lower death rate of 47 per 100,000 versus 112 mesothelioma deaths per 100,000 person years by age at first exposure. They found that the two groups had similar mean residence time in Witternoom, cumulative exposure and lengths of follow up.

8. Hansen et al. (1998) estimated the exposure-response relationship between environmental exposure to crocidolite and mesothelioma in the cohort of former residents of Wittenoom. The cohort consisted of individuals who resided in Wittenoom between 1943 and 1993 for at least one month and were not directly employed by the asbestos industry. Of the 27 subjects, 11 cases were children of men who had worked with crocidolite

at Wittenoom and thus experienced "domestic exposure". They found that the standardised incidence of mesothelioma was 260 per million person years and was similar for both males and females. They reported that time from first exposure, duration of exposure and cumulative exposure all increase the rate of mesothelioma significantly. They also found that those first exposed as children under the age of 10 years had a lower rate of mesothelioma than subjects first exposed after that age (RR = 0.7, 95% CI 0.3-1.5). Of the 27 cases of mesothelioma in the Wittenoom cohort, Hansen et al. reported that nine (33 %) were younger than 40 years at the time of diagnosis resulting from first exposure to crocidolite during childhood. This result of lower rates for children aged < 10 years than those 10 and older at first exposure is a much smaller difference than those found by Reid et al. (2007).

9. Schneider et al. (1996) investigated the development of asbestos induced malignant mesothelioma after non-occupational exposure to asbestos through contact with occupationally exposed household members in their clinic in Germany. Between 1986 and 1994, five women and one young man (aged 42-65 years) with no occupational exposure to asbestos, died of asbestos-induced mesothelioma. For the five women, asbestos exposure was exclusively through residential inhalation of asbestos from contaminated work clothes or shoes that were brought home from the workplace by the husband. As a child, the young man regularly delivered lunch to his father's place of work. The length of household exposure varied from 7 to 23 years, while the latency period from onset of exposure to development of the disease varied from 17 to 39 years.

10. Miller (2005) identified 32 cases of mesotheliomas from the files of nine plaintiff law firms in the US who had no occupational, environmental or other exposure to asbestos other than as a household member of a worker with a clear occupational exposure. Of the 32 cases identified, 12 cases were younger than 7 years of age at first exposure. In total 15 cases were younger than 18 years at first exposure. In terms of relationship to the occupational exposed individual, the authors found that 11 of the cases were parent-daughter relationships and 3 cases were parent–son relationships.

Case Reports

11. Inase et al. (1991) reports on a case of a 38 year-old female presenting with pleural mesothelioma, with a history of neighbourhood and domestic asbestos exposure during her childhood. She lived until the age of 4 in an area that was close to cement factories, nitrogen production factories and a coal mine. She regularly went to the cement factory as her mother worked there. She also played in the hills covered in "*white dust*". She left the area at 4 years of age and had no other known exposure during the subsequent 34 years.

12. Magee et al. (1986) investigated a case of malignant mesothelioma in a 41 year-old male. This individual was exposed as a child to chrysotile products from the Canari mine and to other asbestos products in Corsica such

as crushed serpentine using in road paving. They report that the individual's pulmonary chrysotile fibre burden was well within the range of the general population and the size distribution of the chrysotile fibres also resembled that found in the general population. The individual had an elevated level of tremolite and actinolite asbestos in his lungs compared to the general population. The tremolite asbestos fibres were long in size, with a geometric mean of 3.7 µm. The size data indicated that the geometric mean fibre length was much longer than the tremolite found in chrysotile miners with or without mesothelioma (Churg et al., 1984).

13. Yano et al. (2009) provided details of a case report of a 35 year-old male worker in an asbestos textile plant in China. The worker developed mesothelioma after 4 years of employment in the plant. The paper provided details of his domestic exposure to asbestos as a child through his parents and domestic duties in the home. He resided from birth in workers' residences adjacent to an asbestos containing factory. It was common practice for family members to visit the factory and it was also common for the children to spin asbestos thread in the home. The author concluded that it was the early childhood exposure that contributed to the early development of mesothelioma in this Chinese worker.

14. A case report by Martensson et al. (1984) describes the presence of malignant mesotheliomas in two siblings exposed to asbestos in their homes during childhood. Their father worked at a foundry where asbestos was used for insulation purposes. The cases were exposed to asbestos from their father's working clothing that was hung in the kitchen.

15. Ascoli et al. (2003) identified a cluster of mesothelioma in five siblings. The affected siblings were born and grew up in a small habitation in Naples in Italy where the ground floor and basement of the same building contained a workshop that recycled jute bags. The authors did not have formal confirmation that the recycled jute bags contained asbestos but they indicated that it was very likely that a large proportion of the jute bags that came for recycling came from asbestos cement factories located in Naples. For the five siblings, the period of time spent together was from 1954 -1963. The low mean patient age at diagnosis of 45 years indicated a childhood exposure and corresponds to the 10 year period where the patients lived above the jute bag recycling operation. The time period of exposure also overlaped with time spent by two of the siblings working occasionally in the workshop.

16. In a case report by Cassadori et al. (1992), a 37 year-old woman was diagnosed with diffuse malignant mesothelioma of mixed pattern. The patient did not have any occupational exposure to asbestos but lived from birth to 10 years of age in a house next to an asbestos processing factory. Asbestos exposure was confirmed by identification of asbestos bodies in the bronchoalveolar lavage at a concentration of 0.3 asbestos bodies/ml.

17. Arul and Holt, (1977) described a case report of a 42 year-old female diagnosed with a malignant pleural mesothelioma. It was noted that at the time of diagnosis that the patient had no history of asbestos exposure and

that the tumour appeared to be a spontaneous mesothelioma. Fifteen months into treatment, the patient recollected that she lived near an asbestos factory as a child (from the age of 5-7 years) and played in the neighbourhood of the factory. White dust from the factory settled on houses and after heavy winds, floors and furniture has to be cleaned in the house. The patient left the area after two years and had no other known exposure to asbestos. A post mortem of the patient revealed asbestos bodies in sections of the left lung. Asbestos fibres were also seen and identified as amosite and chrysotile.

18. Li et al. (1989) described a familial cluster of mesothelioma in a household. One daughter died of mesothelioma at the age of 32 years. Throughout her life, she was paraoccupationally exposed to asbestos through her father's soiled work clothes. It was also noted by the authors that during her infancy she was also exposed to asbestos. Cotton cloth sacks in which moulded asbestos insulation had been transported had been utilized to make nappies for the young children of the household. The mother had laundered the nappies and her husband's work clothes, and she died of mesothelioma at age 49. The father, an insulator, died with asbestosis and cirrhosis of the liver at age 53.

References

Arul KJ, Holt PF. Mesothelioma possibly due to environmental exposure to asbestos in childhood. Int Arch Occup Environ Health. 1977, 40(2):141-3.

Ascoli V, Carnovale-Scalzo C, Nardi F, Efrati C, Menegozzo M. A one-generation cluster of malignant mesothelioma within a family reveals exposure to asbestos-contaminated jute bags in Naples, Italy. Eur J Epidemiol. 2003;18(2):171-4.

Cancer Research UK statistics (accessed October 2011) http://info.cancerresearchuk.org/cancerstats/types/Mesothelioma/?script=true

Cazzadori A, Malesani F, Romeo L. Malignant pleural mesothelioma caused by non-occupational childhood exposure to asbestos. Br J Ind Med. 1992, 49(8):599.

Churg A, Wiggs B, Depaoli L, Kampe B, Stevens B. Lung asbestos content in chrysotile workers with mesothelioma. Am Rev Respir Dis. 1984, 130(6):1042-5.

Cooper SP, Fraire AE, Buffler PA, Greenberg SD, Langston C. Epidemiologic aspects of childhood mesothelioma. Pathol Immunopathol Res. 1989, 8(5-6):276-86.

Fraire AE, Cooper S, Greenberg SD, Buffler P, Langston C. Mesothelioma of childhood. Cancer. 1988, 62(4):838-47.

Grundy GW, Miller RW. Malignant mesothelioma in childhood. Report of 13 cases. Cancer. 1972, 30(5):1216-8.

Hansen J, de Klerk NH, Musk AW, Hobbs MS. Environmental exposure to crocidolite and mesothelioma: exposure-response relationships. Am J Respir Crit Care Med. 1998, 157(1):69-75.

Inase N, Takayama S, Nakayama M, Miura H, Kimula Y. Pleural mesothelioma after neighborhood exposure to asbestos during childhood. Jpn J Med. 1991, 30(4):343-5.

Li FP, Dreyfus MG, Antman KH. Asbestos-contaminated nappies and familial mesothelioma. Lancet. 1989, 1(8643):909-10.

Luce D, Billon-Galland MA, Bugel I, Goldberg P, Salomon C, Févotte J, Goldberg M. Assessment of environmental and domestic exposure to tremolite in New Caledonia. Arch Environ Health. 2004, 59(2):91-100.

Magee F, Wright JL, Chan N, Lawson L, Churg A. Malignant mesothelioma caused by childhood exposure to long-fiber low aspect ratio tremolite. Am J Ind Med. 1986, 9(6):529-33.

Mårtensson G, Larsson S, Zettergren L. Malignant mesothelioma in two pairs of siblings: is there a hereditary predisposing factor? Eur J Respir Dis. 1984, 65(3):179-84.

Metintas S, Metintas M, Ucgun I, Oner U. Malignant mesothelioma due to environmental exposure to asbestos: follow-up of a Turkish cohort living in a rural area. Chest. 2002, 122(6):2224-9.

Metintas M, Ozdemir N, Hillerdal G, Uçgun I, Metintas S, Baykul C, Elbek O, Mutlu S, Kolsuz M. Environmental asbestos exposure and malignant pleural mesothelioma. Respir Med. 1999, 93(5):349-55.

Miller A. Mesothelioma in household members of asbestos-exposed workers: 32 United States cases since 1990. Am J Ind Med. 2005, 47(5):458-62.

Muir KR, Parkes SE, Mann JR, Stevens MC, Cameron AH. Childhood cancer in the West Midlands: incidence and survival, 1980-1984, in a multi-ethnic population. Clin Oncol (R Coll Radiol). 1992, 4(3):177-82.

Niggli FK, Gray TJ, Raafat F, Stevens MC. Spectrum of peritoneal mesothelioma in childhood: clinical and histopathologic features, including DNA cytometry. Pediatr Hematol Oncol. 1994, 11(4):399-408.

Reid A, Berry G, de Klerk N, Hansen J, Heyworth J, Ambrosini G, Fritschi L, Olsen N, Merler E, Musk AW. Age and sex differences in malignant mesothelioma after residential exposure to blue asbestos (crocidolite). Chest. 2007, 131(2):376-82.

Reid A, Franklin P, Olsen N, Sleith J, Samuel L, Aboagye-Sarfo P, de Klerk N, Musk AW. All-cause mortality and cancer incidence among adults exposed to blue asbestos during childhood. Am J Ind Med. 2013 Feb;56(2):133-45.

Schneider J, Straif K, Woitowitz HJ. Pleural mesothelioma and household asbestos exposure. Rev Environ Health. 1996, 11(1-2):65-70.

Wasserman, M. and Wasserman, D. Mesothelioma in Children. IARC Sci Pub 1980, 30(92); 253-257.

Whitehouse AC, Black CB, Heppe MS, Ruckdeschel J, Levin SM. Environmental exposure to Libby Asbestos and mesotheliomas. Am J Ind Med. 2008, 51(11):877-80.

Yano E, Wang ZM, Wang XR, Wang MZ, Takata A, Kohyama N, Suzuki Y. Mesothelioma in a worker who spun chrysotile asbestos at home during childhood. Am J Ind Med. 2009, 52(4):282-7.